

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Subsection 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published every two years. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards. (In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.)

This document addresses the water bodies in the Lower Kootenai and Moyie River Subbasins that have been placed on Idaho's 1998 §303(d) list.

The overall purpose of the SBA and TMDL is to characterize and document pollutant loads within the Lower Kootenai and Moyie River Subbasins. The first portion of this document, the SBA, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Sections 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Lower Kootenai and Moyie River Subbasins (Section 5).

1.1. Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Water Environment Federation 1987, p. 9). The act and the programs it has generated have changed over the years, as experience and perceptions of water quality have changed.

The CWA has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to insure "swimmable and fishable" conditions. This goal, along with a 1972 goal to restore and maintain chemical, physical, and biological integrity, relates water quality with more than just chemistry.

1.1.1. Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt water quality standards and to review those standards every three years (EPA must approve Idaho's water quality standards).

Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish a TMDL for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses.

These requirements result in a list of impaired waters, called the “section 303(d) list.” This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *Kootenai River and Moyie River Total Maximum Daily Loads* provides this summary for the currently listed waters in the Lower Kootenai and Moyie River Subbasin.

The SBA section of this document (Sections 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Lower Kootenai and Moyie River Subbasins to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a federally required plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Some conditions that impair water quality do not receive TMDLs. The EPA does consider certain unnatural conditions, such as flow alteration, human-caused lack of flow, or habitat alteration, that are not the result of the discharge of specific pollutants as “pollution.” However, TMDLs are not required for water bodies impaired by pollution but not by specific pollutants. A TMDL is only required when a pollutant can be identified and in some way quantified.

1.1.2. Idaho’s Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation—primary (swimming), secondary (boating)
- Water supply—domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state. If a

water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when the water body is assessed.

An SBA analyzes and integrates multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

1.1.3. Public Participation and Comment Opportunities

The development of the Kootenai and Moyie river SBA and TMDL included extensive public participation and participation by the Kootenai and Moyie River Watershed Technical Committee and oversight by the Watershed Advisory Group (WAG), Kootenai Valley Resource Initiative.

On May 15, 2006, DEQ initiated a 45 day public comment period for the Kootenai and Moyie River TMDLs that continued to June 23, 2006.

DEQ has complied with the WAG consultation requirements set forth in Idaho Code §39-3611. DEQ has provided the WAG with all available information concerning applicable water quality standards, water quality data, monitoring, assessments, reports, procedures and schedules. Indeed, DEQ worked closely with the WAG in collecting the information for the proposed wasteload allocations (WLAs) and in developing the database that reflects the relevant data.

DEQ utilized the knowledge, expertise, experience, and information of the WAG in developing this TMDL. DEQ also provided the WAG with an adequate opportunity to participate in drafting the TMDL and to suggest changes to the document. Subsequent to the development of the original draft SBA proposed in 2003, the WAG has continued to provide DEQ with input, information, and suggestions for the changes through monthly meetings in 2004 and 2005, and the 45 day public comment period.

1.2. Physical and Biological Characteristics

The Kootenai River originates in Canada, crosses the international border in northwest Montana, and flows through the northwest corner of Montana into Idaho before flowing back into Canada. In Idaho, the Kootenai River flows between the Selkirk Mountains to the west and the Purcell Mountains to the east. The Kootenai River basin in Idaho encompasses 1,007 square miles. The majority of the tributaries in Idaho are orientated in an east-west or west-east aspect. The Kootenai River is the second largest tributary to the Columbia River in volume and third largest in drainage area (18,000 square miles).

Physical and biological characteristics include the climate, which is described briefly below, followed by the characteristics of subbasin, subwatersheds, and streams, all of which are broken down for further discussion.

1.2.1. Climate

The wide range of elevation and topographic features in northern Idaho produce a varied climate. The climate is relatively mild for this latitude, indicating a maritime influence. Prevailing westerly winds originating over the Pacific Ocean influence both the summer and winter temperatures, with a stronger maritime effect on the latter. In winter, the strong winds result in a maritime influence that helps to produce relatively mild conditions. However, on some occasions dry arctic air from Canada spills west of the continental divide producing clear skies and a distinct drop in temperatures. In summer, rainfall, cloud cover, and relative humidity are at their annual minimum due to a weakening of the westerly winds which allows continental climatic conditions to prevail (Abramovich et al. 1998).

The maritime air from the prevailing westerly winds is northern Idaho's major source of moisture. Topography plays a large role in determining how much of that moisture falls as precipitation in a particular area. Weather systems heading east off the Pacific coast encounter north-south mountain ranges, followed by relatively flat areas. These mountain ranges force the moist air to rise and cool, expunging much of the moisture as precipitation. Consequently, high elevations and windward mountain slopes receive more precipitation on average than low elevations and areas on the leeward side of mountain ranges.

Annual average precipitation for the Lower Kootenai Basin in Idaho ranges from about 21 inches near the town of Porthill to over 70 inches along the crest of the Selkirk Mountains. Generally, November, December, and January are the wettest months, while July, August, and September are the driest. The majority of precipitation in the region occurs as snowfall.

1.2.2. Subbasin Characteristics

The subbasin characteristics include hydrology, geology, topography, vegetation, and fisheries and aquatic fauna. Each is discussed in detail below.

1.2.2.1. Hydrology

The Kootenai River (spelled Kootenay in Canada) originates in southeastern British Columbia (Figure 5). From the headwaters, it flows south into Lake Koocanusa, which straddles the border between British Columbia and Montana. Libby Dam, operated by the U.S. Army Corp of Engineers, impounds the river to form the Lake Koocanusa Reservoir. Downstream of the dam, near Libby, Montana, the river turns and flows westward toward Idaho. Near Bonners Ferry, Idaho, the river turns north, and flows again into British Columbia (BC) where it enters Kootenay Lake. From the outlet on the west arm of the lake near Nelson, BC, the river flows westward, through several hydropower impoundments, to its confluence with the upper Columbia River near Castlegar, BC.

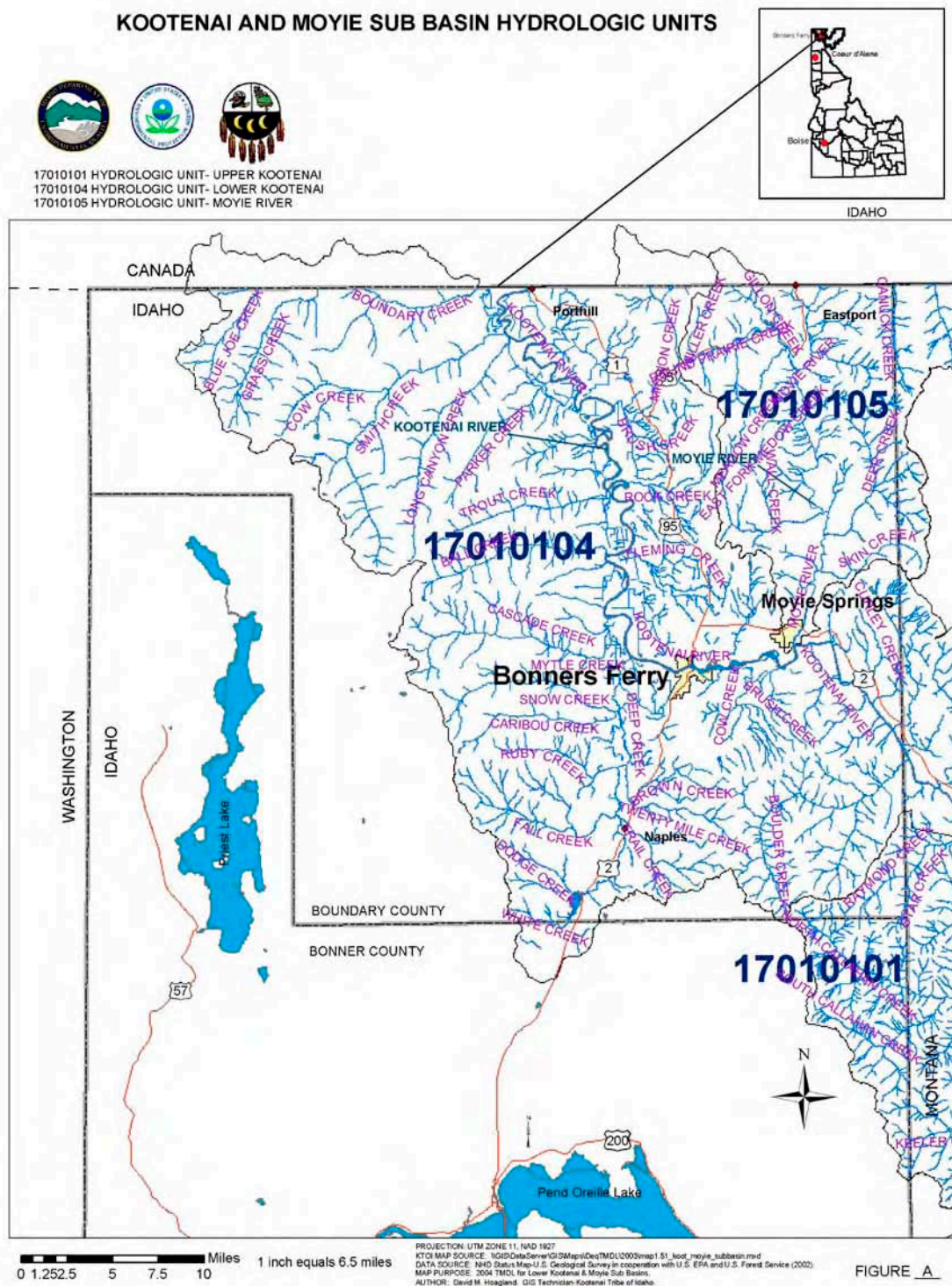


Figure 5. Upper Kootenai, Lower Kootenai, and Moyie River Subbasins in Idaho.

The Moyie River, the largest tributary to the Kootenai River in Idaho, also originates in British Columbia. It crosses the border near Eastport, Idaho, and continues flowing south to where it empties into the Kootenai River near Moyie Springs, Idaho. A hydroelectric project operated by the City of Bonners Ferry dams the river just above Moyie Falls, about 1.5 miles upstream of the mouth.

The Kootenai River in Idaho can be divided into three major reaches with different characteristics. The first 20 km downstream of the Montana state line is primarily a single channel located in a narrow canyon with limited floodplain. This reach is characterized by long runs, with uniform-sized substrate ranging from large gravel to large rubble. There are a few deep pools created by bedrock formations. Aquatic vegetation is rare. The next 10 km of river, immediately above Bonners Ferry, is braided, with several small islands and exposed gravel bars at low flows. Substrates in this reach are generally gravels. The average gradient from Montana to Bonners Ferry is about 0.6 m/km. Below Bonners Ferry, the river flattens to an average gradient of about 0.02 m/km, and begins meandering through the Kootenai Valley, crossing the international border near Porthill. This portion of the river is relatively flat and slow moving, with holes up to 30 m deep. The water level in this reach is affected by operation of the Corra Linn dam on the outlet of Kootenay Lake. The bottom substrate is composed of sand, silt, and clays, with organic materials deposited in eddies and backwaters. Aquatic vegetation is limited and where it is present, it is limited to narrow bands along the shoreline. Dikes have been built on the river banks to prevent flooding of adjacent agricultural lands. Downstream of the border, the river continues its meandering until it enters Kootenay Lake, about 50 km north of Porthill.

The Kootenai River has a mean annual discharge of nine million acre-feet and a flow rate at its mouth of just under 30,650 cubic feet per second (cfs). Mountains in the subbasin receive about 70-80% of their precipitation as snow. The melting of this snowpack during the spring and summer months produces a characteristic “snowmelt hydrograph” in which peak runoff occurs between April and June. Under the terms of the Columbia River Treaty, the U.S. Army Corps of Engineers built Libby Dam in 1973, creating Koocanusa Reservoir (known also as Koocanusa Lake or Libby Reservoir), which spans the Canada-USA border.

Koocanusa Reservoir is a 90-mile-long storage reservoir with a surface area of 188 km² (46,500 acres) at full pool. It is located upstream from the Fisher River confluence and east of Libby, Montana. The dam has a usable storage of approximately 4,930,000 acre feet and gross storage of 5,890,000 acre feet. The primary benefit of the project is power production. With the five units currently installed, the electrical generation capacity is 525,000 kW. The maximum discharge with all five units in operations is about 26,000 cfs. An additional 1,000 cfs can be passed over the spillway without causing dissolved gas supersaturation problems (USACE 2002). The surface elevation of Koocanusa Reservoir ranges from 2,287 feet to 2,459 feet at full pool. Presently, operations are dictated by a combination of power production, flood control, recreation, and special operations for the recovery of ESA-listed species, including Kootenai River white sturgeon (*Acipenser transmontanus*) and bull trout (*Salvelinus confluentus*) and salmon in the lower Columbia River.

Along with the Libby Dam/Koocanusa Reservoir complex, smaller dams are located on the Elk, Bull, and Goat Rivers on the Canadian side and on the Moyie River and Smith and Lake Creeks in the United States. When Kootenay Lake was impounded, the water level increased 7.8 feet, and now the annual drawdown is 9.8 feet. Kootenay Lake stretches 66.4 miles from

the tip of its North Arm, near Lardeau, to the tip of its South Arm, near Creston and has a 28 mile-long West Arm jutting from Balfour to Nelson. The total lake covers 150.5 square miles. On average, its depth is 308 feet, and its width 2.3 miles. A total of 56% of the inflow to the lake is regulated by dams. The outflow from the West Arm, near Nelson, is regulated by the Corra Linn Dam (Living Landscapes 2003).

Stream density and water yield are relatively high throughout the basin. The largest Idaho tributary systems include the Moyie River, Deep Creek, Boundary Creek, and Boulder Creek. Many of the tributary streams that enter the Idaho portion of the Kootenai River flow from hanging valleys over bedrock controls, with steep sections and impassable fish barriers. Annual discharge in the Idaho tributaries averages about 2 cfs per square mile of drainage.

The wetlands within Boundary County, Idaho were converted during the early 1900s for agricultural purposes. A network of drainage ditches was completed to establish 16 taxing districts and a few additional drainage districts. A remnant large wetland occurs at the south end of the valley from ancient Mirror Lake. There are two primary U.S. Fish and Wildlife Service wetland designations within the Kootenai River Valley that are identified as palustrine (shallow ponds, marshes, bogs, or swamps) and riverine (rivers, creeks, and streams).

The drainage ditches were excavated into areas which are seasonally flooded areas with persistent hydrophytic vegetation. There are cropland areas within the valley that are temporarily flooded during February and March. These areas are scattered throughout the Kootenai River Valley, typically adjacent to the meanders.

A large permanently flooded wetland exists as Kerr Lake near Copeland. There are natural slough areas (oxbows) or channels adjacent to the river east of Bonners Ferry along Cow Creek road.

The Kootenai River includes wetlands contained within and immediately adjacent to the channel. The system is a permanent perennial open water channel. However, the river has been diked within the floodplain to reduce flooding on agricultural fields. An extensive network of marshes, tributary side channels, and sloughs were formed by lowering of the glacial Kootenay Lake level, flooding, and the river reworking its floodplain. Some of these wetlands continued to be supported by groundwater recharge, springtime flooding, and channel meandering.

1.2.2.2. Geology

The geology of these subbasins is shown in Figure 6 and Figure 7.

The underlying bedrock of the Kootenai River drainage downstream of Libby Dam consists primarily of belt series rock. Intrusions of igneous rock are scattered throughout the area, which has been highly influenced by glacial activity from both continental ice masses and alpine glaciation.

Mountains in the subbasin are composed of folded, faulted, and metamorphosed blocks of Precambrian sedimentary rocks of the Belt Series and minor basaltic intrusions (Ferreira et al. 1992). Primary rock types are meta-sedimentary argillites, siltites, and quartzites, which are hard and resistant to erosion. Where exposed, they form steep canyon walls and confined stream reaches. The porous nature of the rock and glaciation has profoundly influenced basin and channel morphology (Hauer and Stanford 1997).

During the Pleistocene, continental glaciation overrode most of the Purcell Range north of the river, leaving a mosaic of glacially scoured mountainsides, glacial till, and lake deposits. Late in the glacial period, an ice dam blocked the outlet at the West Arm of Kootenay Lake. The dam formed glacial Kootenay Lake, the waters of which backed all the way to present-day Libby, Montana. Glacial Kootenay Lake filled the valley with lacustrine sediments, which included fine silts and glacial gravels and boulders. A terrace of lacustrine sediments on the east side of the valley is approximately 400 feet above the current floodplain and is a remnant of the ancestral valley floor. Tributary streams working through remnant deposits to meet the present base level of the mainstem and from the mainstem reworking existing floodplain and stream bank deposits continue to be a source of fine sediments.

General soil units are shown in Figure 8 for the Lower Kootenai River Subbasin and Figure 9 for the Moyie River Subbasin. Soil associations, described below, group soils according to broad patterns of soil composition, relief, drainage, and geographic distribution.

The Schnoorson-Ritz-Farnhamton Association includes somewhat poorly drained to poorly drained soils on floodplains and low stream terraces mainly along the Kootenai River. They are level to gently sloping, very deep, silt loams, silty clay loams, and mucky silt loams. Soils of minor extent are DeVoignes, Pywell, and Seelovers. Most of this unit is drained and protected from flooding. It is used for cropland, hay and pasture, or wildlife habitat. The main limitations are a seasonal high water table, hazard of flooding, hazard of soil piping – a type of subsurface erosion that can result in unstable ground and stream bank erosion.

The Rubson-Porthill Association includes well drained to moderately well drained soils on high terraces and benches above the Kootenai River floodplain. They are nearly level to rolling, very deep, silt loams with silt loam to silty clay subsoils. Soils of minor extent are Selle and Elmira. Most of this unit is used for cropland, hay and pasture, woodland, homesites, or wildlife habitat. The main limitations are the hazard of water erosion and a seasonal perched water table in the Porthill soil.

The Selle-Elmira Association includes well drained to excessively drained soils on high terraces and benches above the Kootenai River floodplain. They are nearly level to hilly, very deep, fine sandy loams and loamy fine sands. Soils of minor extent are Rubson. Most of this unit is used for hay and pasture, woodland, cropland, homesites, or wildlife habitat. The main limitations are the hazards of seepage, cutbanks caving, soil droughtiness, and wind erosion.

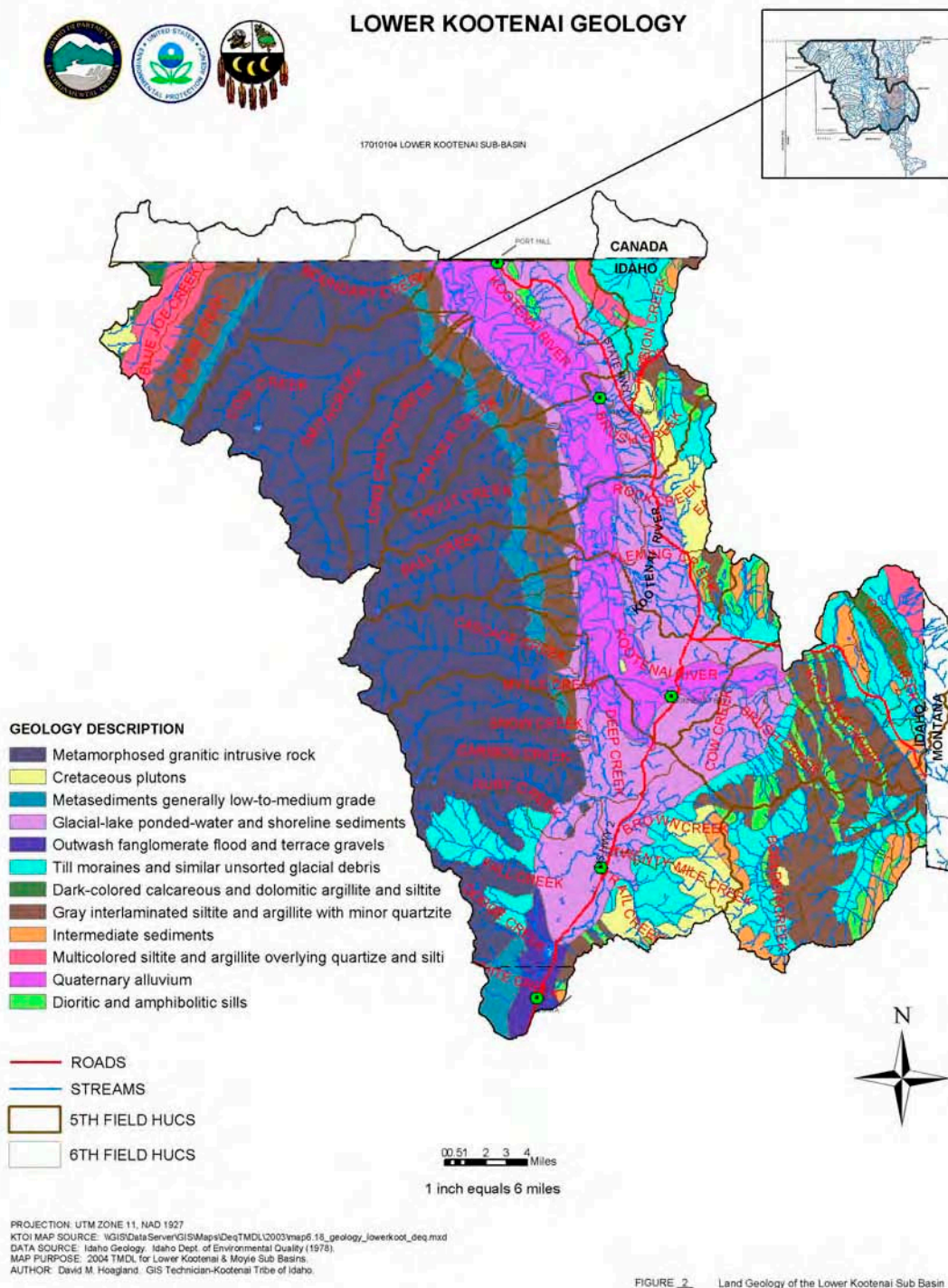


Figure 6. Lower Kootenai River Subbasin geology.

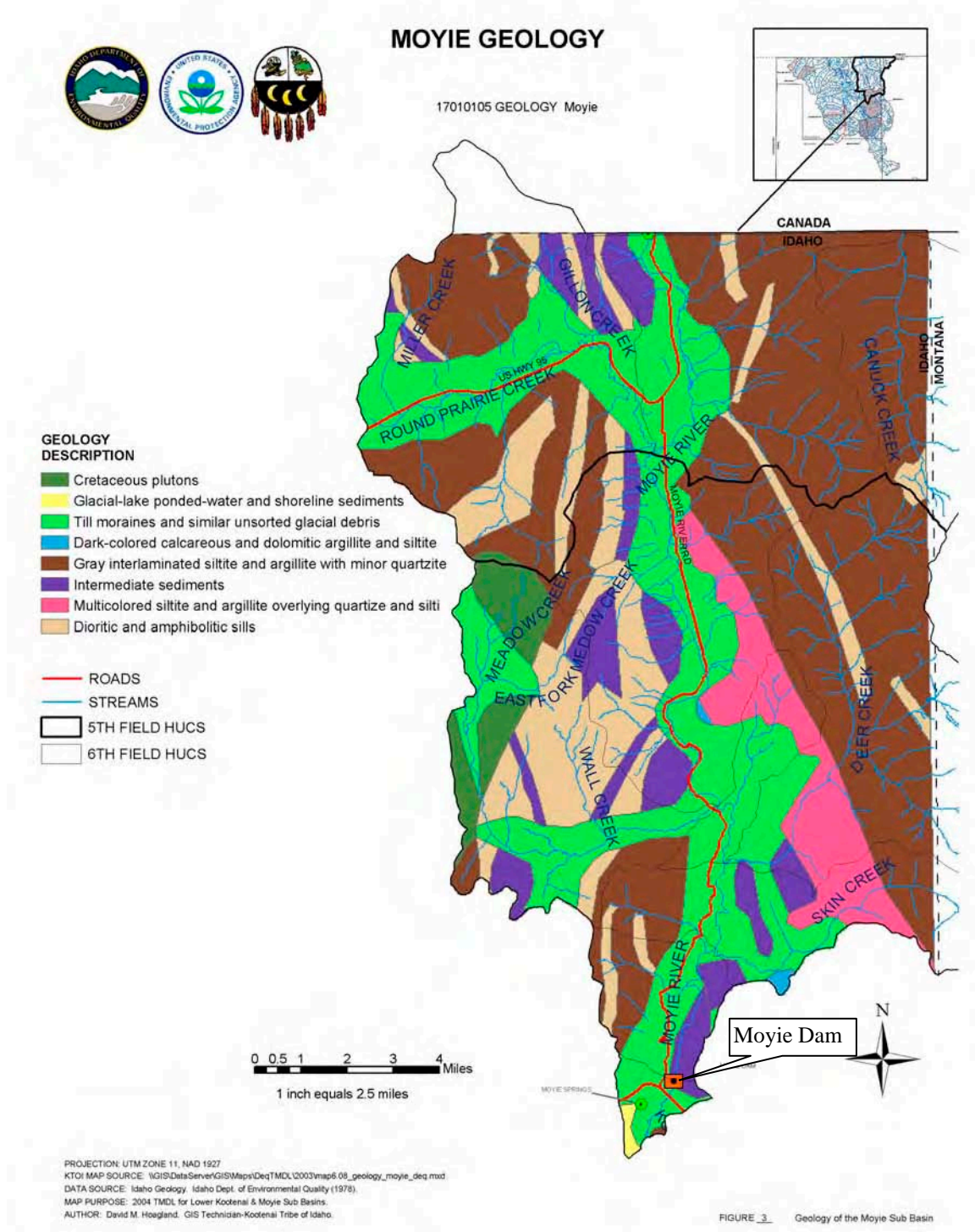


Figure 7. Moyie River Subbasin geology.

The Wishbone-Crash-Artnoc Association includes well-drained soils on terrace escarpments above the Kootenai River floodplain. They are steep to very steep, very deep silt loams. Soils of minor extent are Caboose and Pend Oreille. Most of this unit is used for woodland, livestock grazing, or wildlife habitat. The main limitations are slope, the hazard of water erosion, soil slippage, and soil piping.

The Pend Oreille-Idamont-Rock Outcrop Association includes well-drained soils and rock outcrop on mountains and foothills above the Kootenai River floodplain. They are moderately sloping to very steep, very deep, silt loams high in volcanic ash with gravelly or cobbly sandy loam subsoils. Soils of minor extent are Treble and Kriest. Most of this unit is used for woodland, livestock grazing, wildlife habitat, and recreation. The main limitations are slope, the hazard of seepage, and large stones in some areas.

The Stien-Pend Oreille Association includes well-drained soils on glacial moraines, high terraces, and footslopes above the Kootenai River floodplain. They are nearly level to moderately steep, very deep, silt loams and gravelly silt loams high in volcanic ash with cobbly or very cobbly sandy loam, loamy sand, or sand subsoils. Soils of minor extent are Treble, Selle, and Rubson. Most of this unit is used for woodland, livestock grazing, wildlife habitat, homesites, and recreation. The main limitations are large stones, the hazard of seepage, cutbanks, caving, droughtiness of the Stien soil, and slope in some areas.

1.2.2.3. Topography

Elevations in the Idaho portion of the Lower Kootenai River Subbasin range from peaks over 7,000 feet in the Selkirks down to 1,746 feet where the Kootenai River returns to Canada. The river divides the Selkirk mountain range to the west from the Purcell Mountains to the northeast, and the Cabinet Mountains to the southeast. Of all stream miles in the Lower Kootenai Subbasin, in Idaho, 28% have <2% grade, 23% have 2-6% grade, and 49% have >6% gradient. In the U.S. portion of the Moyie Subbasin, 19% of stream miles are <2% grade, 14% have a 2- 6% grade, and 67% are steeper than 6% grade.

The Federal government has classified nine species of plant and animals that occur within the Lower Kootenai River Subbasin as threatened (T) or endangered (E) under the Endangered Species Act. They include the gray wolf (E), woodland caribou (E), grizzly bear (T), Canada lynx (T), bald eagle (T), bull trout (T), white sturgeon (E), water howellia (T), and Spalding's catchfly (T). The peregrine falcon was formerly listed as endangered but was delisted in 1999. It is now considered recovered subject to five years of monitoring.

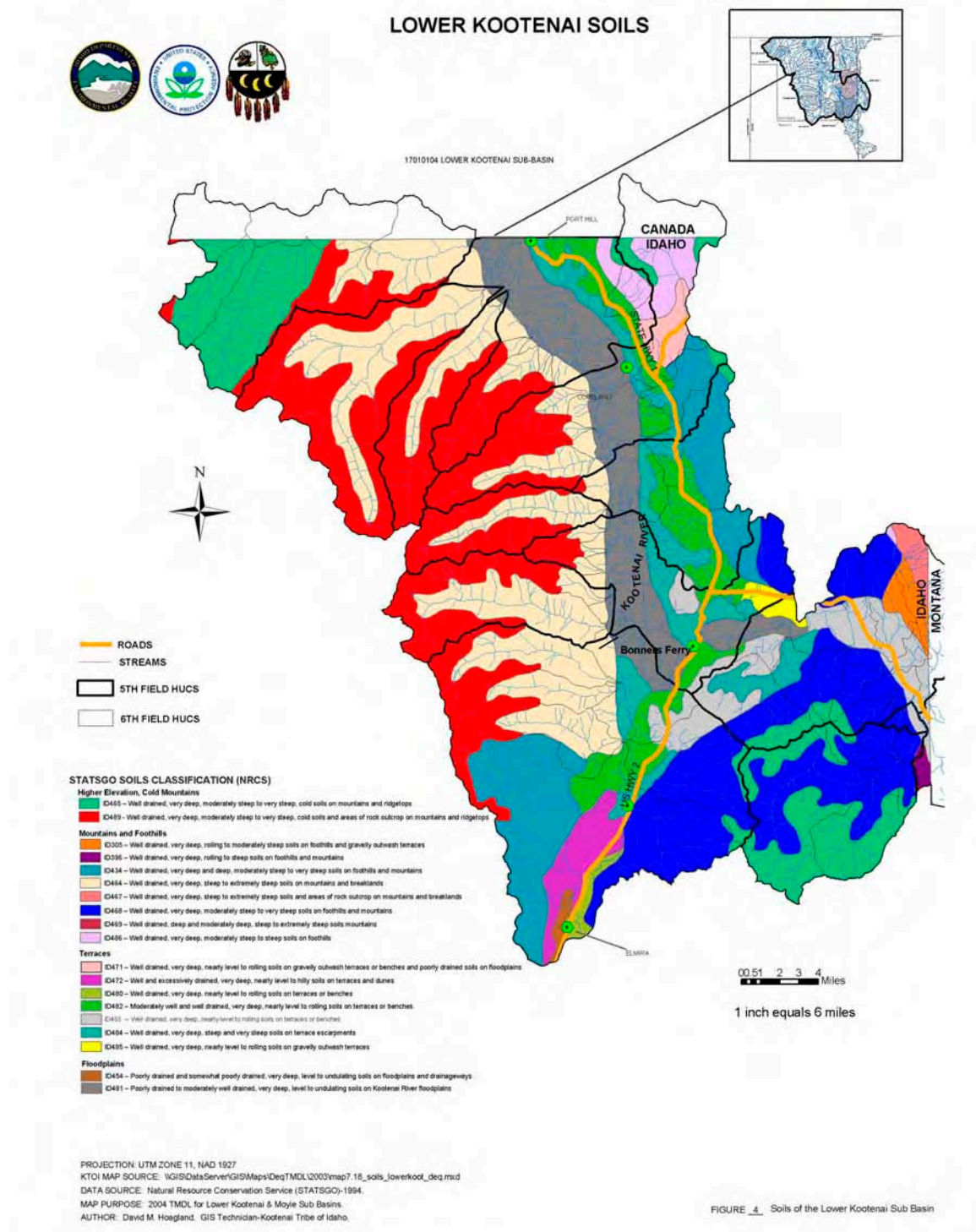


Figure 8. Lower Kootenai River Subbasin soils.

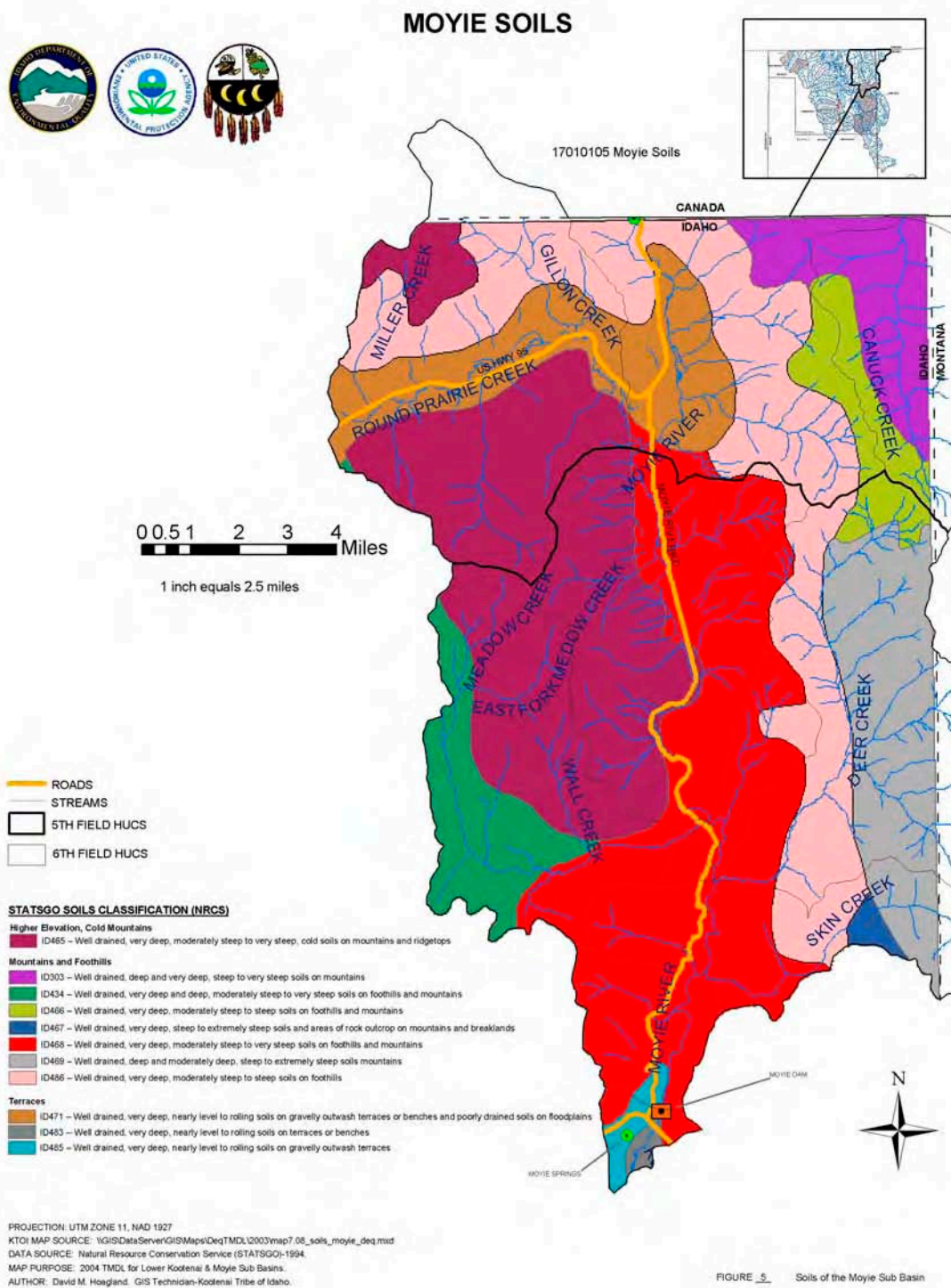


Figure 9. Moyie River Subbasin soils.

1.2.2.4. Fisheries and Aquatic Fauna

There are six native salmonid species in the Lower Kootenai River Subbasin. They are bull trout, (*Salvelinus confluentus*) westslope cutthroat trout (*Oncorhynchus clarki lewisi*), redband rainbow trout (*Oncorhynchus mykiss ssp.*), kokanee salmon (*Oncorhynchus nerka*), pygmy whitefish (*Prosopium coulteri*), and mountain whitefish (*Prosopium williamsoni*). In addition to the endangered white sturgeon (*Acipenser transmontanus*), the Kootenai River also contains Idaho's only population of native burbot (*Lota lota*), a species of special concern. The salmonids, and burbot species are discussed in more detail below.

Distribution of fish species are shown in Figure 10 for the Lower Kootenai River Subbasin and Figure 11 for the Moyie River Subbasin.

Bull Trout

Bull trout (*Salvelinus confluentus*) populations in Idaho may exhibit one of three life history forms: resident, fluvial, or adfluvial. Resident bull trout generally spend their entire life cycle in small headwater streams. Fluvial and adfluvial bull trout spawn in tributary streams where the juveniles rear from one to four years before migrating to either a river system (fluvial) or a lake/reservoir system (adfluvial) where they grow to maturity (Fraley and Shepard 1989). All three life history forms are present in the Lower Kootenai River Subbasin.

Adfluvial bull trout mature at four to seven years of age (Mallet 1969; Pratt 1985; Shepard et al. 1984; Goetz 1989) and may spawn every year or in alternate years (Block 1955; Fraley and Shepard 1989; Pratt 1985; Ratliff 1992). Adfluvial fish grow larger in size and have higher average fecundities than fluvial or resident stocks.

The majority of adfluvial and fluvial bull trout spawning occurs in a small percentage of the total available stream habitat. Spawning takes place between late August and early November, principally in third and fourth order streams. Spawning adults use low gradient areas (< 2%) of gravel/cobble substrate with water depths between 0.1 and 0.6 m and velocities from 0.1 to 0.6 meters per second (m/s). Proximity of cover for the adult fish before and during spawning is an important habitat component. Spawning tends to be concentrated in reaches influenced by groundwater where temperature and flow conditions may be more stable. Spawning habitat requirements of resident bull trout are poorly documented.

Successful incubation of bull trout embryos requires water temperatures below 8 °C, less than 35-40% of sediments smaller than 6.35 mm in diameter, and high gravel permeability. Eggs are deposited as deep as 25.0 cm below the streambed surface and the incubation period varies depending on water temperature. Spawning adults can alter streambed characteristics during redd construction to improve survival of embryos, but conditions in redds often degrade during the incubation period. Mortality of eggs or fry can be caused by scouring during high flows, freezing during low flows, superimposition of redds, or deposition of fine sediments or organic materials. A significant inverse relationship exists between the percentage of fine sediment in the incubation environment and bull trout survival to emergence. Entombment is likely a significant mortality factor during incubation. Groundwater influence plays a large role in embryo development and survival by mitigating mortality factors.

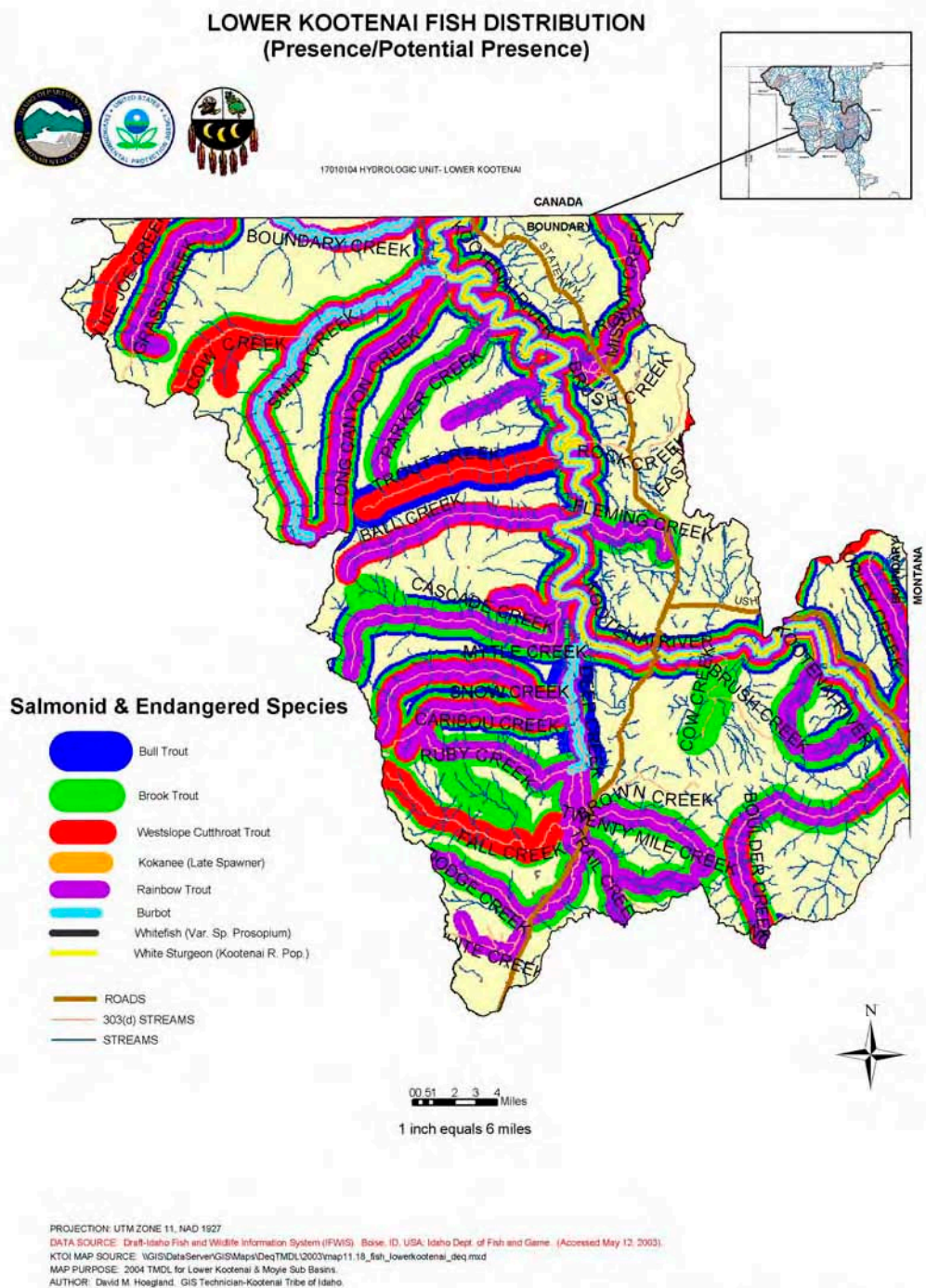


FIGURE 14. Fish Presence for the Lower Kootenai basin

Figure 10. Distribution of fish species in the Lower Kootenai River Subbasin.

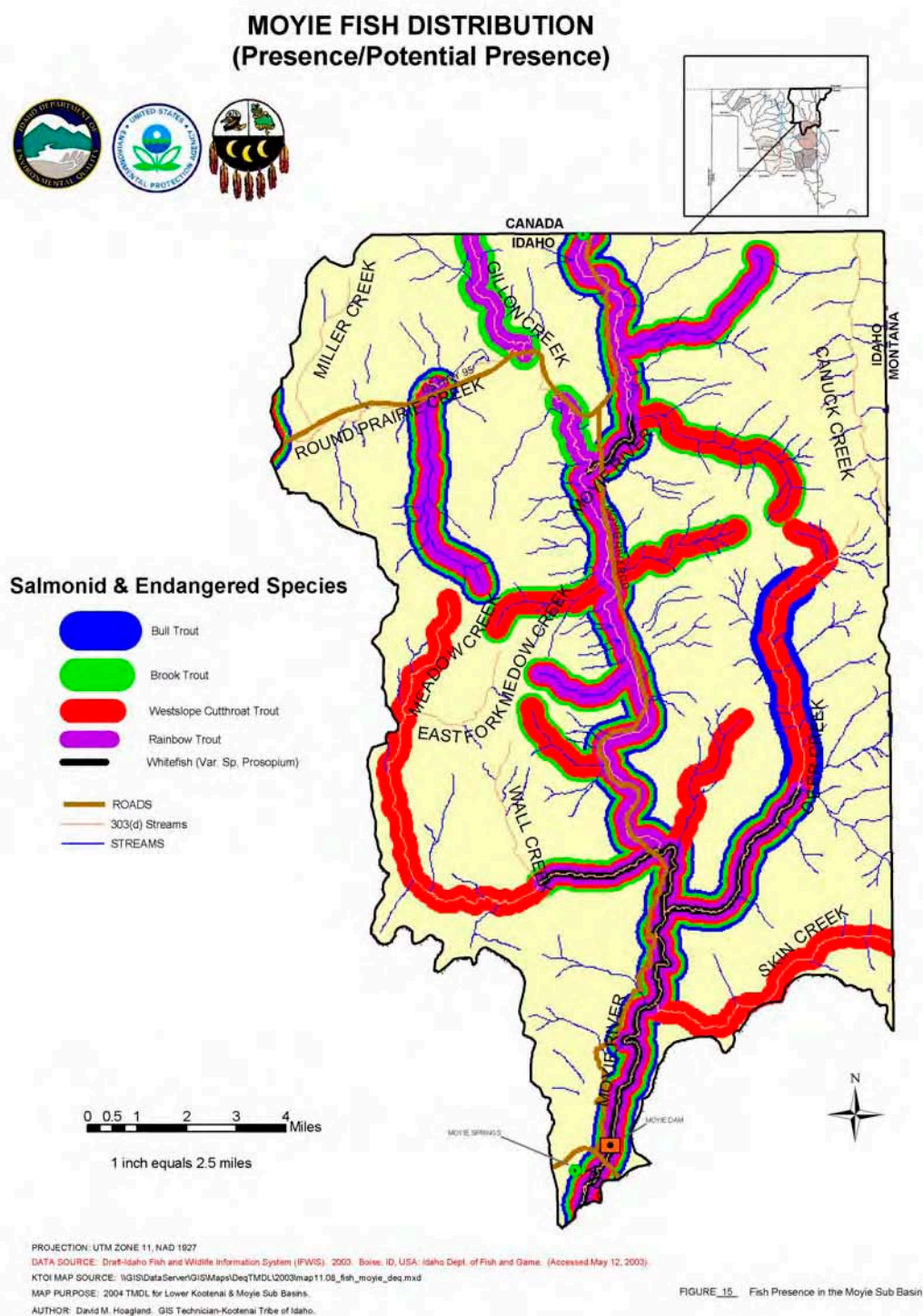


Figure 11. Distribution of fish species in the Moyie River Subbasin.

Rearing habitat requirements for juvenile bull trout include cold summer water temperatures (15 °C) provided by sufficient surface and groundwater flows. Warmer temperatures are associated with lower bull trout densities and can increase the risk of invasion by other species that could displace, compete with, or prey on juvenile bull trout. Juvenile bull trout are generally benthic foragers, rarely stray from cover, and prefer complex forms of cover. High sediment levels and embeddedness can result in decreased rearing densities. Unembedded cobble/rubble substrate is preferred for cover and feeding, and also provides invertebrate production. Highly variable streamflow, reduction in large woody debris, bedload movement, and other forms of channel instability can limit the distribution and abundance of juvenile bull trout. Habitat characteristics that are important for juvenile bull trout of migratory populations are also important for stream resident subadults and adults. However, stream resident adults are more strongly associated with deep pool habitats than are migratory juveniles.

Both migratory and stream-resident bull trout move in response to developmental and seasonal habitat requirements. Migratory individuals can move great distances (up to 250 km) among lakes, rivers, and tributary streams in response to spawning, rearing, and adult habitat needs. Stream-resident bull trout migrate within tributary stream networks for spawning purposes, as well as in response to changes in seasonal habitat requirements and conditions. Open migratory corridors, both within and among tributary streams, larger rivers, and lake systems are critical for maintaining bull trout populations.

Westslope Cutthroat Trout

The distribution and abundance of westslope cutthroat trout (*Oncorhynchus clarki lewisi*) has declined from historic levels across its range, which includes western Montana's Kootenai River drainage (Liknes and Graham 1988). Westslope cutthroat trout persist in only 27% of their historic range in Montana. Due to hybridization, genetically pure populations are present in only 2.5% of that range (Rieman and Apperson 1989). Introduced species have hybridized or displaced westslope cutthroat trout populations across their range. Hybridization causes loss of genetic purity of the population through introgression. Some remaining genetically pure populations of westslope cutthroat trout are found above fish passage barriers that protect them from hybridization, but isolate them from other populations. Westslope cutthroat trout are common in the Kootenai National Forest.

Brook trout are believed to have displaced many westslope cutthroat trout populations (Behnke 1992). Where the two species co-exist, westslope cutthroat trout predominate in higher gradient reaches and brook trout prevail in lower gradient reaches (Griffith 1988). This isolates westslope cutthroat trout populations, further increasing the risk of local extinction from genetic and stochastic factors (McIntyre and Rieman 1995).

Westslope cutthroat trout exhibit both the migratory and resident life histories on the Kootenai National Forest. Westslopes are capable of traveling over 100 miles during spawning migration. Migratory fish typically rear in their natal streams until their third year, at a length of 7-9 inches, when they migrate to either a larger stream or lake to rear to maturity. Resident fish are significantly smaller than their migratory counterparts. Sexual maturity is attained at either age four or five, at lengths of 4-16 inches, at which time these fish migrate back to their natal streams to spawn. Westslopes can typically reach lengths in excess of 20 inches and weigh in excess of three pounds. Common lifespan for this species is

seven years. Westslopes feed primarily on aquatic insects in streams and larger zooplankton in lakes.

Westslope cutthroat occur in about 1,440 linear miles of stream habitat in the U.S. portion of the Lower Kootenai River Subbasin. Abundance data are available for 1,051 of those stream miles. Approximately 70 percent of those have stocks that are considered abundant. Data for the Montana portion of the Kootenai River Basin from the Interior Columbia Basin Ecosystem Management Project indicate westslope cutthroat trout stocks are strong or predicted strong in 15 HUCs, depressed or predicted depressed in 159 HUCs, and absent or predicted absent in the remaining 11 HUCs. In the Idaho portion of the Kootenai River Basin, westslope cutthroat trout presence is known or predicted in 41 HUCs and absent in two. Westslope cutthroat trout status is known or predicted strong in four HUCs and known or predicted depressed in 37 HUCs.

Shepard and others (2003) reported that among the streams surveyed in the U.S. portion of the Lower Kootenai Subbasin, stocks of unintrogressed (i.e., not demonstrating genetic influences from other species) cutthroat trout occupied 142.5 miles; stocks that are less than 10% introgressed occupied 29.5 miles; stocks between 25% and 10% introgressed occupied 86.3 miles; and stocks greater than 25% introgressed occupied 576.5 miles. Westslope cutthroat trout stocks inhabiting 197.1 miles of stream are suspected to be unintrogressed (with no record of stocking or contaminating species present), and stocks inhabiting 1,498 miles are potentially altered (potentially hybridized with records of contaminating species being stocked or occurring in stream).

The Montana Chapter of the American Fisheries Society (MTAFS) identified over exploitation, genetic introgression and competition from nonnative fish species, and habitat degradation as three primary reasons for the decline of westslope cutthroat trout in Montana.

In a HUC-by-HUC assessment of all Kootenai River Subbasin 6th field HUCs in the U.S., a technical team concluded that of the habitat attributes considered most important to resident salmonids, the most limiting for westslope cutthroat trout when averaged across all the HUCs in the U.S. portion of the subbasin are riparian condition, fine sediment, channel stability, and habitat diversity, in that order. In the Canadian portion of the subbasin they are riparian condition, habitat diversity, channel stability, and fine sediment.

Redband Trout

The redband trout (*Oncorhynchus mykiss*) is a widely distributed western North America native salmonid. Resident interior redbands can be further divided into two forms – the adfluvial interior redband or "Kamloops rainbow" and others, which annually migrate between a lake and tributary river in order to complete their lifecycles, and the fluvial interior redband, which remain in a river system throughout its life (Moyle et al. 1989). The potential for both exists in the Upper Kootenai Subbasin.

The historic range of the interior redband included freshwaters west of the Rocky Mountains, extending from northern California to northern British Columbia, Canada (Behnke 1992). Presently the only population of pure strain redbands occurs in the Upper Kootenai Subbasin in Callahan Creek near the Montana and Idaho border.

Redbands spawn in the spring, from March through June (Kunkel 1976). Fry emerge from the stream-bottom approximately two months after spawning and begin a stream residence

that may last one-year to a lifetime (Scott and Crossman 1973). Adfluvial and migratory fluvial redband juveniles will typically move downstream to their ancestral lake or river after one to three years of residence in the headwaters. Sexual maturity typically occurs at three to five years except in cold or hot climates where life expectancy is shortened. Where native interior redbands and westslope cutthroat occur in the same habitats, the two species appear to have evolved strategies to limit introgression as evidenced in the Yaak River tributaries.

The subspecies is known to occupy waters between 700 and 1,500 meters in elevation (D. Perkinson, personal communication). The distribution of the subspecies may be influenced by watershed productivity, presence of barriers, channel hydraulics, distribution of prey species, possibly large-river fluvial forms, suitable riparian overstory cover, and substrate conditions.

Interior redband have been found in watersheds as small as five square kilometers, but the subspecies is generally known from far more productive waters where piscivory supports fish up to 35 pounds (Perkinson 1995; Scott and Crossman 1973). Nearly every pure strain population is found upstream of barriers. Redbands select riffle habitats with an apparent preference for cobble substrates and boulder formed small in channel pools in summer (Kunkel 1976; D. Perkinson, personal communication).

One species that presents substantial threat to redbands is the coastal rainbow. The widespread culture and stocking of coastal rainbow stocks, or hybrid redband, steelhead, and rainbow, throughout the redband's range, has led to substantial losses of the native genotype (Behnke 1992; Campton and Johnston 1985).

The status of Montana redband trout populations is presumed to be stable (J. Dunnigan, Montana Fish and Wildlife, personal communication 2004). In the Idaho Panhandle National Forest, little is known about the status of Kootenai-drainage redband trout populations. In all but five of the 6th-field HUCs in the Idaho portion of the Kootenai River watershed, the redband trout status is described by the United States Forest Service (USFS) as "presence unknown." In three HUCs, redbands are known to be present but their population status is unknown, and in two they are present but depressed. PWI (1999) reports that the rainbow trout population in the lower Kootenai River itself (downstream of Kootenai Falls) may be the strongest stock of all the salmonids, but that the genetic integrity of the native interior redband has been significantly compromised through stocking of non-native rainbow strains and hybridization with cutthroat trout. An assessment of Kootenai Subbasin 6th-field HUCs concluded the most limiting habitat attributes for redband trout in U.S. tributaries are riparian condition, fine sediment, high temperature, and channel stability, in that order.

In the mainstem, the most limiting factors were altered hydrograph due to Libby Dam, riparian condition, elevated temperature, and fine sediment. In the Canadian portion of the subbasin, the most limiting habitat attributes include riparian condition, channel stability, fine sediment, and habitat diversity. The rankings vary at the fourth field watershed scale. Biological limiting factors in U. S. tributaries include non-native species, system productivity, and connectivity between the mainstem and tributaries. Biological limiting factors in the U. S. mainstem include non-native species and system productivity. In lakes, the most limiting attributes are hydraulic regime, migratory obstructions, shoreline condition, and temperature.

Kokanee Salmon

From a subbasin perspective, most kokanee (*Oncorhynchus nerka*) populations appear relatively stable and abundant, bearing in mind that the impacts of the Duncan and Libby dams were never fully assessed. Therefore, pre-dam population levels are unknown. Abundance is a relative term, with today's observations of abundance most likely considered sparse by previous generations of Native Americans and early Europeans. There are currently six populations of kokanee in the Kootenai River Subbasin in Idaho, Montana, and British Columbia.

Native kokanee salmon runs in lower Kootenai River tributaries in Idaho have experienced dramatic population declines during the past several decades (Ashley and Thompson 1993; Partridge 1983). The kokanee that historically spawned in these tributaries inhabited the South Arm of Kootenay Lake in British Columbia. Native kokanee are considered an important prey item for white sturgeon and also provided an important fishery in the tributaries of the lower Kootenai River (Partridge 1983; Hammond, J., B.C. MELP, personal communication 2000). Kokanee runs into North Idaho tributaries of the Kootenai River that numbered into the thousands of fish as recently as the early 1980s have now become "functionally extinct" (Anders 1993; Kootenai Tribe of Idaho, unpublished data). Since 1996, visual observations and redd counts in five tributaries found no spawners returning to Trout, Smith, and Parker Creeks, while Long Canyon and Boundary Creeks had very few kokanee returns.

In a HUC-by-HUC assessment of all Kootenai Subbasin 6th-field HUCs in the U.S., the technical team concluded that of the habitat attributes considered most important to resident salmonids, the most limiting for kokanee, when averaged across all the HUCs in the U.S. portion of the subbasin, were low flow, channel stability, high flow, and fine sediment, in that order. In the Canadian portion of the subbasin they were channel stability, fine sediment, riparian condition, habitat diversity. In the lakes assessed, the limiting factors were hydraulic regime, volumetric turnover rates, migratory obstructions, and trophic status.

Burbot

The burbot (*Lota lota*) is common in the upstream reaches of the Columbia River Basin in the northwestern U.S. and Canada. In Idaho, burbot are endemic only to the Kootenai River, while they also occur in this same river system as well as Kootenay Lake in British Columbia. The Kootenai River and Kootenay Lake once provided popular sport, subsistence, and commercial fisheries for burbot. However, soon after Libby Dam became operational and Lake Koocanusa was formed, in 1972, the respective burbot fisheries in the Kootenai River, Idaho and Kootenay Lake, British Columbia, diminished significantly. Several changes have occurred on the Kootenai River, but the most serious impact is thought to be Libby Dam, constructed by the U.S. Army Corps of Engineers for hydropower and flood control. Shortly after the dam became operational, the fishery in Kootenay Lake rapidly diminished from an annual harvest of over 26,000 burbot in 1969 to none in 1987. Angling regulations for burbot fishing in both bodies of water became more restrictive, but the fisheries did not improve; both fisheries were eventually closed. The main reasons for the loss of both fisheries are believed to be high winter flows during the traditional spawning period for burbot, loss of nutrients to the impoundment created by Libby Dam, and warmer winter temperatures. Fisheries and river managers joined as a Kootenai River Burbot

Conservation Committee to formulate a conservation strategy to prevent further losses and identify actions needed to rehabilitate the burbot population. These conservation strategies propose measures that are thought necessary for the rehabilitation of burbot in the lower Kootenai River; measures include ecosystem rehabilitation, modification of the present flood curves to reduce flow during the winter migration and spawning season for burbot, the use of behaviorally and genetically similar donor stocks, confined brood stocks, burbot culture, an additional turbine on Libby Dam, and spring management of Kootenay Lake elevation. Rehabilitation of the burbot population is believed more likely if all of the measures are implemented and the process is facilitated through managing agencies with public involvement.

The burbot, locally referred to as the "ling" or "ling cod", is the only freshwater member of the cod family. Burbot are typically associated with larger streams or rivers and deep, cold lakes or reservoirs. Historically, they inhabited the mainstem Kootenai River and a few of its tributaries. Recent research below Libby Dam estimates the current population in that area to be near 1,000 individuals (range 680-1,700).

Although spawning has been confirmed below Libby Dam, it is not known if burbot spawn below Kootenai Falls in Montana.

Burbot may also occur in the Yaak River below Yaak Falls. Distribution of burbot is limited to the Kootenai River on the Kootenai and Idaho Panhandle National Forests. Burbot are a cold-water, bottom-dwelling species. Burbot are eel-like with marbled body coloration from dark olive to brown on the back contrasted with brown or black; the sides are lighter than the back; and the belly is yellowish white (Simpson and Wallace 1982). Burbot have a distinguishing single slender barbel on the chin. In the lower Kootenai River, burbot can weigh up to 10 pounds and live up to 15 years.

Burbot that occur in the Kootenai River basin exhibit three life history strategies in several potentially isolated groups. The burbot that constitute the lower Kootenai River population spend a portion of their life in the South Arm of Kootenay Lake, and then migrate up the Kootenai River during the winter months to spawn in the mainstem river or tributary streams in British Columbia or Idaho (an adfluvial life form, i.e., one that migrates from lake to river and tributary streams for spawning). Kootenai Falls in Montana, present for approximately 10,000 years, physically isolates this population of burbot from the population that occurs above the falls (Paragamian et al. 1999). Burbot above the falls are believed to spend their entire lives in the river system (a fluvial life form, i.e., one that spends its entire life in the river or migrates from river to tributary streams for spawning). A burbot population also exists in Lake Koocanusa, a reservoir formed when Libby Dam was constructed near Libby, Montana, in the early 1970s.

Under natural conditions, burbot in the Kootenai River basin spawn under ice during the winter months in water temperatures below 4°C (39 °F) (Simpson and Wallace 1982). Spawning commences in early February and lasts two to three weeks.

Most information suggests that river spawning burbot prefer low velocity areas in main channels or in side channels behind deposition bars, with the preferred substrate consisting of fine gravel, sand, or silt (Fabricius 1954 in McPhail and Paragamian 2000; McPhail and Paragamian 2000). Spawning is also known to occur in small tributary streams and is

generally believed to take place at night (Simpson and Wallace 1982; McPhail and Paragamian 2000).

Female burbot are larger than males and, depending on their size, may produce between 50,000 and 1,500,000 eggs (Simpson and Wallace 1982). Male burbot typically reach sexual maturity in three to four years, with females maturing in four to five years (BRS, in draft). During spawning, burbot typically collect in a large mass referred to as a spawning ball, with one or more females in the center surrounded by many males (Simpson and Wallace 1982; McPhail and Paragamian 2000). There is no site preparation during spawning, and eggs are broadcast into the water column well above the substrate. The eggs are semi-buoyant and eventually settle into cracks in the substrate. Newly hatched burbot drift passively in open water until they develop the ability to swim (McPhail and Paragamian 2000). Young burbot initially select shoreline areas among rocks and debris for feeding and habitat security.

Burbot prefer cold water and, during summer months, move to the hypolimnion (lower zone of a thermally stratified lake) areas of lakes or deep-water pools of large rivers (Simpson and Wallace 1982). Feeding is mostly done at night, with adult burbot feeding almost exclusively on fish. Young burbot feed on a variety of aquatic organisms, such as insects, amphipods, snails, and small fish (Simpson and Wallace 1982). Burbot are most active in the winter when they move great distances to spawn, but are rather sedentary during the non-spawning seasons.

The lower Kootenai River once supported a significant number of burbot and provided an important winter fishery to the region. Although declines in burbot numbers in Idaho and British Columbia had been documented as early as 1959, they were still considered relatively stable through the 1960s. Despite fishery regulations implemented in the 1970s, the burbot populations in the Idaho and British Columbia portion of the basin declined after the construction of Libby Dam in 1972. Only 145 adult burbot have been captured in the Kootenai River in Idaho and British Columbia since 1993 (Paragamian et al. 1999). Spawning was known to occur in many tributary streams in Idaho and likely occurred in the river (BRS, in draft). However, recent studies reveal scant evidence of burbot reproduction in Idaho, as no larval fish and only one juvenile fish have been captured since 1993 (Paragamian and Whitman 1999). Currently, the only tributary known to support spawning burbot is the Goat River, which is just north of the Idaho border in British Columbia (Paragamian 1995a; Paragamian, in draft).

Prior to the diminishment of the lower Kootenai River burbot population in the 1970s, anglers reported catching more than 40 burbot a night during the winter using setlines. The estimated annual harvest for the sport and commercial fishery was in the tens of thousands of kilograms or several thousand fish annually (BRS in draft; Paragamian, personal communication 2000). However, the annual harvest of burbot between 1979 and 1983 was estimated at about 250 fish. With continued declines, both BC and Idaho fisheries were closed in the 1990s.

Declines in lower Kootenai River burbot appear to be most strongly associated with habitat modification resulting from the construction and operation of Libby Dam (Paragamian 1993; Paragamian et al. 1999). Temperature and flow changes that alter spawning patterns and poor fry survival due to a reduction in food productivity in the river are believed to be the primary

threats to burbot (Paragamian 1993; Paragamian and Whitman 1998; Paragamian et al. 1999).

In addition to flow change, winter water temperature has increased by 4 to 5 °F (2 to 3°C) since the construction of Libby Dam. This temperature increase is believed to influence the activity level and location of burbot during the pre-spawn migration. Prior to the construction of Libby Dam, many portions of the lower Kootenai River would freeze allowing burbot to spawn under ice in water temperatures between 34 and 37°F (1 and 3°C) (Becker 1983 in Paragamian 1995a). Lower Kootenai River temperatures are now 39 to 41°F (4 to 5°C) during the winter months and many sections no longer freeze over (Paragamian 1995a).

The decline in the productivity of the Kootenai River and in Kootenay Lake following the construction of Libby Dam may also be linked to the decline of burbot. Sediment and nutrients settle behind Libby Dam in Lake Koocanusa and reduce the nutrient loading to the river. Analyses of macrozooplankton in the lower Kootenai River indicated that there is a scarcity of important foods such as *Daphnia*, *Diaphanosoma*, and *Cyclops* (Paragamian 1995b).

In the summer of 2005 The Kootenai Tribe of Idaho, in conjunction with The Idaho Department of Fish and Game, began the Kootenai River Nutrient Addition Project. The goal of the project is to reverse the effects of depleted nutrients in the Kootenai River. Nutrient addition outfall is located west of the Idaho/Montana border, and anticipated to treat 17 miles of river from the Idaho/Montana border to Bonner's Ferry, ID. Addition of nutrients is hypothesized to stimulate food web production and help restore populations of trout, kokanee, mountain whitefish and the endangered burbot and white sturgeon (Hardy and Holderman).

Nutrient discharge amounts from the project are flow dependant and will occur between June 1st and September 30th. Discharge must consist of ammonium polyphosphate and urea ammonium nitrate at a flow rate and concentration necessary to achieve an approximate soluble reactive phosphorous concentration of 3ug/L and nitrate nitrite concentrations of 30-50ug/L in the Kootenai River downstream of the discharge. The nutrient addition project must adhere to strict monitoring protocols and results of sampling must be reported to EPA each month during operation.

1.2.3. Subwatershed Characteristics

The Lower Kootenai River Subbasin in Idaho consists of roughly eighteen subwatersheds and a few minor first order tributaries to the Kootenai River. Portions of eleven of the eighteen subwatersheds lay either in Canada or Montana.

1.2.4. Stream Characteristics

Streams in the Idaho portions of the Lower Kootenai and Moyie River Subbasins generally have steep gradients with riffle dominated morphologies. Streams not contained in the floodplain are high energy, moderately entrenched, and in places, cascading. Tributaries within the Kootenai River floodplain are generally low gradient, riffle/run and meandering. Smaller tributaries entering the Kootenai and Moyie Rivers are generally orientated in an east-west or west-east direction. Following are more detailed descriptions of Deep Creek,

Boundary Creek, Cow Creek, Blue Joe Creek, Boulder Creek, Caribou Creek, and the Moyie River in Idaho

1.2.4.1. Deep Creek

Deep Creek is a 116,760-acre watershed in the southwest corner of the Lower Kootenai River Subbasin. Deep Creek debouches into the Kootenai River approximately three miles downstream from Bonners Ferry. Major tributaries within the Deep Creek drainage include Brown Creek, Twentymile Creek, Trail Creek, Dodge Creek, Fall Creek, Ruby Creek, Caribou Creek, and Snow Creek. The drainage is oriented in a northerly direction with side tributaries entering mostly from the west and east. Average precipitation across the Deep Creek watershed is 36 in/yr. Mean annual discharge from the creek is 336 cfs. High-volume runoff occurs during spring snowmelt and major rain-on-snow events.

The Deep Creek drainage is predominantly underlain by glacial till, coarse textured alluvium, highly and weakly weathered Belt Supergroup metasediments, and highly weathered and weakly weathered granitics of the Kaniksu Batholith. These highly and weakly weathered rocks are typically divided, with the highly weathered material occurring along the lower elevations and the weakly weathered material occupies the uplands and ridgelines.

Much of the low lying floodplain is dominated by grasslands and mixed conifer/broadleaf vegetation types. Forested riparian areas along floodplains typically support mixed grasses, forbes, broadleaf and needleleaf hydrophilic species. South to west facing slopes at lower elevations support stands of ponderosa pine, lodgepole pine, and Douglas fir vegetation types. As side slope elevation increases forest stands generally become denser with a greater number of coniferous species. The presence of Douglas fir, grand fir, western hemlock, western red cedar, western larch, western white pine, and subalpine fir increases with increasing elevation and effective precipitation.

Ownership within the Deep Creek watershed is mixed. The United States Forest Service (USFS), Idaho Department of Lands (IDL), Forest Capital, and Stimson Lumber Company all manage sections of timber land, mostly in the higher elevations of the watershed. Lowlands are primarily privately owned, and include areas of forest, wetlands, agriculture, and residential development. Part of the Kootenai National Wildlife Refuge lies adjacent to the lower end of Deep Creek.

1.2.4.2. Boundary Creek

Boundary Creek is a third order tributary located in north Idaho and flows parallel to the Idaho/Canada international border. Boundary Creek flows into the Kootenai River approximately 100 meters north of the international border. Major tributaries to Boundary Creek include Blue Joe Creek, Grass Creek and Saddle Creek. For the purpose of this assessment, the portions of Boundary Creek referenced are from the Idaho/Canadian border to Idaho/Canadian border, west to east. Land within the United States portion of the watershed is publicly owned and managed by the USFS.

Boundary Creek is orientated in a west-east direction with a dendritic stream feeder pattern to the Kootenai River. Elevation in the watershed ranges from 3,400 feet above sea level where the creek enters Idaho from Canada to 1,760 feet above sea level where the creek enters back into Canada.

The Boundary Creek drainage is predominantly underlain by weakly weathered granites of the Kaniksu Batholith. The area is characterized by warm, dry summers and cold, wet winters. The majority of the precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. The majority of the watershed is vegetated by coniferous species.

1.2.4.3. Cow Creek

Cow Creek is a 13,528-acre watershed in north Idaho and is entirely contained in Boundary County. Lower portions of the watershed are forested while the upper portion of the watershed is an area of historic burn and is now managed as a cattle grazing allotment. For the purposes of this assessment, Cow Creek, along with major and minor tributaries are all combined and referred to in this report as Cow Creek. Cow Creek flows into Smith Creek approximately 7.5 miles upstream from the Smith Creek confluence with the Kootenai River.

Land ownership is primarily public and managed by the USFS. A small portion of the watershed along the Selkirk Crest is managed by the IDL. Privately owned land does exist in the watershed on a limited basis.

Cow Creek is a second order tributary, with a dendritic stream feeder pattern to Smith Creek. The watershed is orientated in a westerly direction with tributaries entering from the north and south. Elevation in the watershed ranges from 3,560 feet above mean sea level where Cow Creek merges with Smith Creek to 6,893 feet above mean sea level.

Cow Creek drainage is predominantly underlain by weakly weathered granites of the Kaniksu Batholith. The area is characterized by warm, dry summers and cold, wet winters. The majority of the precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. The majority of the watershed is vegetated by coniferous species.

1.2.4.4. Blue Joe Creek

Blue Joe Creek is a 6,002-acre forested watershed located in north Idaho and entirely contained in Boundary County. For the purpose of this assessment, Blue Joe Creek, along with major and minor tributaries, are all combined and referred to in this report as Blue Joe Creek. Blue Joe Creek is orientated in a northerly direction with the headwaters and majority of the watershed located in the United States. Blue Joe Creek is a second order tributary to Boundary Creek after flowing north and crossing the United States/Canada international border.

Land ownership is primary public with a small section of privately owned land located near the headwaters of Blue Joe Creek. Publicly owned land in the watershed is managed by the United States Forest Service. Privately owned land in the watershed is confined to the area of the historic Continental Mine site. The Continental Mine was a silver mine in operation from the 1890s to the 1950s. Silviculture activities exist within the watershed on a limited basis.

Blue Joe Creek is a second order tributary to Boundary Creek with a dendritic stream feeder pattern. Tributaries to Blue Joe Creek are orientated in an east and west aspect. Elevation in the watershed ranges from 4,115 feet above mean sea level to 6,677 feet above mean sea level.

The Blue Joe Creek watershed is predominantly underlain by metasedimentary rocks and minor portions of the Kaniksu Batholith. The granite and metasedimentary rocks are typically divided, with the highly weathered material occurring along the lower elevations and the weakly weathered material occupying the uplands and ridgelines.

The area is characterized by warm, dry summers and cold, wet winters. The majority of the precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. The majority of the watershed is vegetated by coniferous species.

1.2.4.5. *Boulder Creek*

Boulder Creek is an 40,533-acre watershed west of Bonners Ferry, Idaho, and flows into the Kootenai River less than a half mile west of the Idaho/Montana border. The Boulder Creek watershed is a relatively unentered watershed, with the majority of silviculture activity occurring to the east of East Fork Boulder Creek. Major tributaries to Boulder Creek include East Fork Boulder Creek, McGinty Creek, Gable Creek and Pinochle Creek. For the purposes of this assessment, Boulder Creek, along with major and minor tributaries, are all combined and referred to in this report as Boulder Creek. The Boulder Creek watershed is almost entirely located in Boundary County with a small portion of the southern edge protruding into Bonner County. Land within the watershed is publicly owned and managed by the United States Forest Service.

Boulder Creek is a third order tributary, with a dendritic stream feeder pattern to the Kootenai River. The drainage is orientated in a north by northeasterly direction with side tributaries entering from the east, west, north and south. Elevation in the watershed ranges from 1,828 feet above mean sea level where Boulder Creek enters into the Kootenai River to 6,705 feet above mean sea level.

The Boulder Creek watershed is predominantly underlain by highly and weakly weathered Belt Supergroup metasediments. The Belt Supergroup metasediments are typically divided, with the highly weathered material occurring along the lower elevations and the weakly weathered material occupying the uplands and ridgelines.

The area is characterized by warm, dry summers and cold, wet winters. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. The majority of the watershed is vegetated by coniferous species such as Douglas-fir, grand fir, western larch, lodgepole pine, western red cedar, subalpine fir, and white pine.

1.2.4.6. *Caribou Creek*

Caribou Creek is an 8,418-acre forested watershed in northern Idaho of which 8,369 acres are managed for timber production the remainder is managed for agriculture or occupied by homesites. For the purposes of this assessment, Caribou Creek, along with major and minor tributaries, are all combined and referred to in this report as Caribou Creek. Caribou Creek flows into Snow Creek approximately 1/8 mile upstream of Deep Creek. Land ownership is primarily public, including in the Panhandle National Forest, managed by the USFS, Bonners Ferry Ranger District, the Bureau of Land Management; and State of Idaho, managed by the Idaho Department of Lands, Kootenai Valley Area Office. There are smaller areas of private land. The watershed is located in Boundary County, Idaho.

Caribou Creek is a second order tributary, with a dendritic stream feeder pattern, to the Deep Creek. The drainage is oriented in an east by northeasterly direction with side tributaries entering mostly from the north and south. Elevation in the watershed ranges from 1,740 feet where Caribou Creek empties into Snow Creek to 7,260 feet in the headwaters on Roman Nose.

The Caribou Creek drainage is predominantly underlain by highly and weakly weathered granitics of the Kaniksu Batholith, and very minor inclusions of coarse textured alluvium and highly weathered Belt Supergroup metasediments. The granite rocks and metasediments are typically divided, with the highly weathered material occurring along the lower elevations and dominating the main stem floodplain and lower tributary floodplains. The weakly weathered material occupies the uplands and ridgelines.

The area is characterized by warm, dry summers and cold, wet winters, with an average annual precipitation ranging from 25 inches at the lower elevations to 50 inches at the higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. The open lowlands near the mouth of the river are a mixed landscape of forested and non-forested areas, which are dominated by grasses and forbs. Forested riparian areas along floodplains typically support mixed broadleaf and needleleaf hydrophilic species. Strong south to west facing slopes at lower elevations support Douglas fir, lodgepole pine, and ponderosa pine vegetation types. With increasing elevation, forest stands become denser with a greater numbers of conifer species. The presence of Douglas-fir, grand fir, western larch, lodgepole pine, western red cedar, and western white pine increases with increasing elevation and effective precipitation. Higher elevations grade into subalpine vegetative types that include subalpine fir and spruce interspersed with brushy glades. At the very highest elevations, especially where glacial scouring and past wildfire impacts are strongest, vegetation becomes purely alpine, with no trees and abundant rock outcrop.

1.2.4.7. Streams Removed as TMDL Candidates

Three of the streams listed on the 1998 §303(d) list (Blue Joe Creek, Boulder Creek and Caribou Creek) have been removed as candidates for sediment TMDL development. Draft TMDLs were developed that demonstrated that current sediment generating conditions were better than those that assured full support of the beneficial uses in the area. Additionally, the listings were based on 1995 Beneficial Use Reconnaissance Project data which are contrary to more recent data collected, and Stressor Identification Analysis (EPA 2000) performed by DEQ supported their removal as TMDL candidates.

The in-stream water quality targets for the Blue Joe, Boulder and Caribou Creek's sediment TMDLs are to achieve full support of the cold water designated use (Idaho Code 39.3611, .3615). Specifically, sedimentation must be reduced to a level where full support of beneficial uses is demonstrated using the current assessment method accepted by DEQ at the time the water body is reassessed.

Draft TMDLs were developed for these streams that included loading capacities in terms of mass per unit time. Pollution reduction goals (targets) were set based on conditions from neighboring watersheds that supported cold water aquatic life. All sources of sediment to Blue Joe, Boulder and Caribou Creek are nonpoint sources. The draft TMDL addresses the nonpoint sediment yield to the watershed.

The draft TMDLs apply sediment allocations in tons per year and calculate sediment reduction goals. According to the evidence outlined in chapter 5, the 50% above background target appears to be reasonable and very protective of the beneficial uses of the watersheds in the Lower Kootenai River Subbasin. In developing the draft TMDLs for these streams, DEQ discovered loads in Blue Joe, Boulder and Caribou Creeks are less than 50% above background levels. Estimated loads compared to load capacities are shown in Table 1 for Blue Joe Creek, Table 2 for Boulder Creek, and Table 3 for Caribou Creek.

Table 1. Blue Joe Creek sediment load, background, and load capacity at the point of compliance.

Load Type	Location (BURP ¹ Site ID Number)	Acreage of Watershed	Estimated Existing Load (tons/year)	Natural Background (tons/year)	Load Capacity at 50% above Background (tons/year)	Estimation Method
Sediment	Blue Joe Creek BURP ID 1994SCDA A033	6,002	211	180	270	GIS Estimate*

¹Beneficial Use Reconnaissance Program

*Steps taken to derive GIS estimates can be found in Appendix F

Table 2. Boulder Creek sediment load, background, and load capacity at the point of compliance.

Load Type	Location (BURP ¹ Site ID Number)	Acreage of Watershed	Estimated Existing Load (tons/year)	Natural Background (tons/year)	Load Capacity at 50% above Background (tons/year)	Estimation Method
Sediment	Boulder Creek BURP ID 1994SCDA A033	40,533	1,234	1,216	1,824	GIS Estimate*

¹Beneficial Use Reconnaissance Program

*Steps taken to derive GIS estimates can be found in Appendix F

Table 3. Caribou Creek sediment load, background, and load capacity at the point of compliance.

Load Type	Location (BURP ¹ Site ID Number)	Acreage of Watershed	Estimated Existing Load (tons/year)	Natural Background (tons/year)	Load Capacity at 50% above Background (tons/year)	Estimation Method
Sediment	Caribou Creek BURP ID 1994SCDA A033	8,376	251	251	376	GIS Estimate*

¹Beneficial Use Reconnaissance Program

*Steps taken to derive GIS estimates can be found in Appendix F

1.2.4.8. Moyie River

Moyie River Lower Sidewalls is a 920-acre watershed in north Idaho. Moyie River Lower Sidewalls consists of a low gradient reach with broad depositional areas and steep canyon walls. Land in the area supports a multitude of uses including agriculture, an industrial site, rural and urban development, recreational sites and siculture. For the purposes of this assessment, Moyie River Lower Sidewalls, along with major and minor tributaries, are all combined and referred to in this report as Moyie River Lower Sidewalls.

Moyie River Lower Sidewalls flows into Kootenai River approximately 1 mile below the Moyie Falls Dam at Moyie Springs, Idaho near U.S. Highway 2. Land ownership is primarily public and managed by USFS Bonners Ferry Ranger District; Kaniksu National Forest, Bureau of Land Management, private timber corporations, private railroad interests and small private land owners. The watershed is wholly located in Boundary County, Idaho (Figure 5).

Moyie River Lower Sidewalls is a fourth order tributary to the Kootenai River, with a dendritic stream feeder pattern. The drainage is oriented in a southerly direction with side tributaries entering mostly from the northwest and east. Elevation in the watershed ranges from 1,790 feet where Moyie River Lower Sidewalls empties into Kootenai River to 4,445 feet in the headwaters.

The Moyie River Lower Sidewalls drainage is predominantly underlain by glacial outwash drift/till, Columbia River basalt flow material, and highly and weakly weathered Belt Supergroup metasediments. The Belt Supergroup metasediments are typically divided, with the highly weathered material occurring along the lower elevations and lower tributary floodplains where they occur. The weakly weathered material occupies the uplands and ridgelines.

The area is characterized by warm, dry summers and cold, wet winters, with an average annual precipitation ranging from 20 inches at the lower elevations to 30 inches at the higher elevations. The majority of precipitation occurs as winter snowfall and spring rain. High-volume runoff occurs during spring snowmelt and major rain-on-snow events. Vegetation varies with elevation and aspect. Much of the low lying floodplain is dominated by grasses, forbs, and mixed conifer/broadleaf vegetation types. Forested riparian areas along floodplains typically support mixed grasses, forbs, alder/willow, western red cedar/western hemlock vegetation types, and other hydrophilic species. Strong south to west facing slopes at lower elevations support stands dominated by ponderosa pine vegetation types. Forest stands generally become denser with a greater number of coniferous species as elevation and effective precipitation increase as noted by the presence of Douglas fir, grand fir, western hemlock, western red cedar, western white pine, western larch, western spruce, and sub-alpine fir.

Moyie River, from the Moyie River Dam to its confluence with the Kootenai River, is listed for TMDL development on the 1998 §303(d) list, with excess sediment as its pollutant. DEQ does not have Beneficial Use Reconnaissance Program monitoring data on this section of Moyie River, and believes listing decisions were based anecdotal understandings and information. DEQ has evidence suggesting that the listing resulted from a single fine

sediment deposition event, and that the stream has recovered since that event (see Figure 12, showing the river in 1984). Mechanisms are in place to prevent similar events from occurring. Therefore, DEQ and the Kootenai and Moyie River WAG maintains that TMDL calculations are inappropriate and that the section of Moyie River below the dam be removed from the §303(d) list. Future monitoring should be continued in the Moyie River watershed for future evaluation of beneficial use status.

In 1984 the Moyie River received a large quantity of sediment from a single event. The event was a sediment release resulting from the operation of the Moyie hydroelectric project. The Moyie hydroelectric project consists of a small run of the river reservoir and a low head dam that is operated by the City of Bonners Ferry. According to DEQ file notes: On Saturday, August 18, 1984, the City of Bonners Ferry used the drain valve of the Moyie hydroelectric project in order to gain above water access for cleaning and repair of the trash racks. The dam was drawn down 51 feet overnight. As a result of the draining, a tremendous amount of fine sediment that had been held upstream below surface banks was deposited downstream and buried the Moyie Springs and Three Mile water intakes. The fine sediment made it impossible for these two systems to pump water from the river (DEQ 1984). According to a newspaper article (Bonners Ferry Herald 1984), the mudslide was unexpected.



Figure 12. Moyie River, 1984.

According to Bonners Ferry staff, quantities of fine sediment behind the dam were not apparent. The City of Bonners Ferry has not seen the accretion of fine sediment behind that dam like that seen in 1984 at any other time. It is believed that the fine sediment existing in 1984 resulted from ash deposition related to the May 1980 Mount St. Helens eruption (Stephen Boorman 2005). DEQ staff visited the Moyie River on August 29, 2005, and observed “little to no fine sediment in the section below the dam” (see Figure 13, showing the same location on the river in 2005).

Mechanisms are in place to prevent similar events from occurring at the Moyie hydroelectric project. The United States Federal Energy Regulatory Commission (FERC) has issued an order approving City of Bonners Ferry's Sediment Removal Plan. This plan outlines consultation with Idaho DEQ, USFWS, and the Kootenai Tribe. When sediments upstream from the dam accumulate, the City of Bonners Ferry must remove and dispose of these sediments. Disposal must be conducted during low flow periods, using a portable cutter-head suction dredge, and allowed to settle in un-lined basins. Drain exercises will be conducted when flows are in excess of 2000 cfs (FERC 2005).



Figure 13. Moyie River, 2005.

1.3. Cultural Characteristics

The Lower Kootenai and Moyie River Subbasins contain an abundance of natural resources, transportation, and economic possibilities. From times when the Kootenai Tribe of Idaho inhabited the land, to the discovery of gold in 1863 (Bonners Ferry Chamber of Commerce 2003), the Lower Kootenai and Moyie River Subbasins have grown and changed, providing a strong historical and cultural background.

1.3.1. Land Use

The Lower Kootenai and Moyie River Subbasins consist primarily of forested land. Examples of forest land use within the basin include timber harvest, recreation, wilderness and mineral extraction to name a few. Greater than 90% of Boundary County is forested, with the Selkirk, Purcell, and Cabinet Mountain Ranges crossing the county. Much of the Lower Kootenai and Moyie River Subbasins are located within the Kaniksu National Forest,

while the Idaho portion of the Upper Kootenai River Subbasin is located within the Kootenai National Forest.

Along with forest land in the Lower Kootenai and Moyie River Subbasins, dry land agriculture and rangeland also exist, but to a much smaller extent, as shown in Figure 14 and Figure 15. Fertile farming grounds are restricted to roughly 50,000 acres along the old floodplain of the Kootenai River valley and bench areas above the floodplain. Along the floodplain, crops such as spring and winter wheat and canola, spring barley, timothy, and white clover are grown. In the bench areas, spring and winter wheat, spring barley, alfalfa hay and seed, and grass hay are grown (Bonners Ferry Chamber of Commerce 2003).

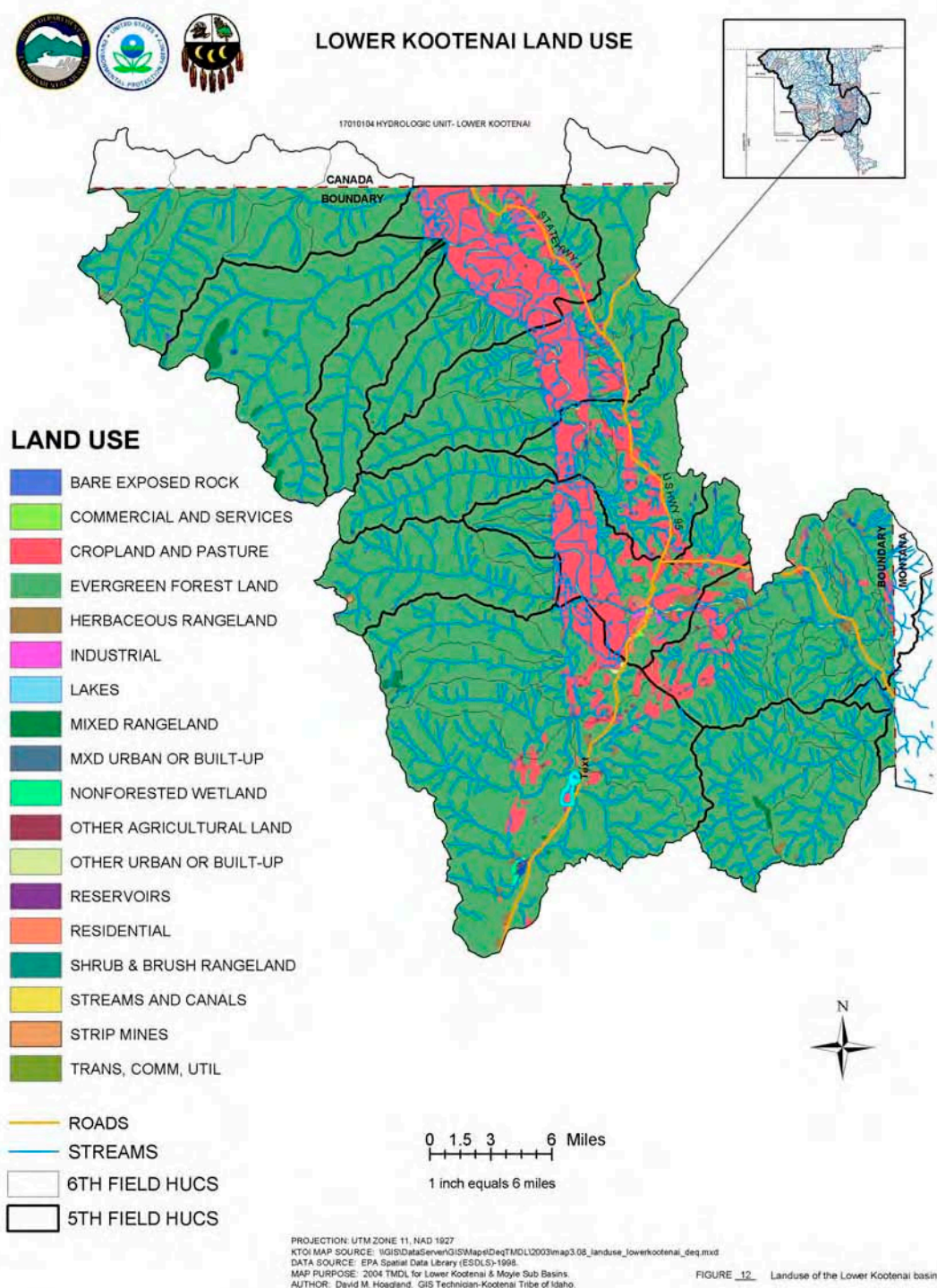


Figure 14. Land use types in the Lower Kootenai River Subbasin.

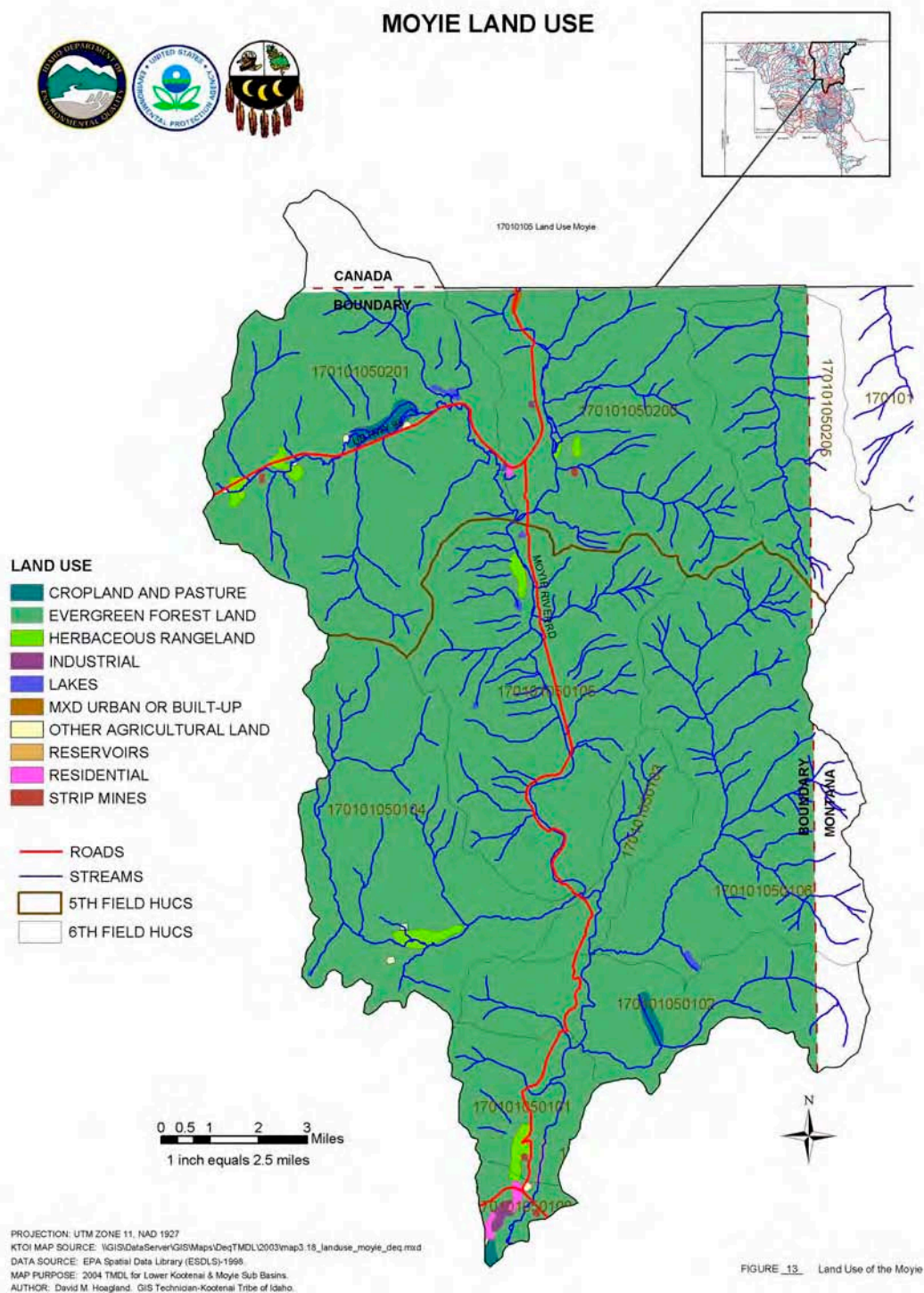


Figure 15. Land Use Types in the Moyie River Subbasin.

A number of road systems in the Lower Kootenai and Moyie Subbasins exist. Currently, the Boundary County Road and Bridge Department maintains 340 miles of public roadway in Boundary County, while the Idaho Department of Transportation maintains 78 miles along U.S. 95, Highway 1, and U.S. 2 (Boundary County Chamber of Commerce 2003).

1.3.2. Land Ownership, Cultural Features, and Population

The United States Forest Service and private entities own the majority of the land in the Lower Kootenai and Moyie Subbasins. Figure 16 shows land ownership in the Lower Kootenai Subbasin and Figure 17 shows land ownership in the Moyie Subbasin. The Lower Kootenai Subbasin consists of 530,236 acres in Idaho and the Moyie Subbasin consists of 113,365 acres in Idaho. Privately owned land is in the form of dry land agriculture along the fertile Kootenai River Valley (215,658 acres); however, approximately 100,000 acres are forested. The Idaho Department of Lands (24,385 acres), the Bureau of Land Management (4,976 acres), the United States Fish and Wildlife Department (2,814 acres), and the Idaho Department of Fish and Game (1,622 acres) manage the remaining land.

As shown in Figure 17, the Moyie Hydroelectric Dam is the only major dam within the three subbasins. It is located just upstream from Moyie Falls in the Moyie Subbasin and is owned by the City of Bonners Ferry. First licensed in 1949, the dam stands 92 feet high, and produces 3,950 kilowatts of electricity. The license is issued by the Federal Energy Regulatory Commission (FERC).

The City of Bonners Ferry holds the only two National Pollution Discharge Elimination Systems (NPDES) permits in Boundary County. The permits, issued by EPA on November 5, 1998, are for wastewater and water treatment systems. These are the only permitted point sources of pollution in the Upper and Lower Kootenai and Moyie Subbasins.

The majority of the Lower Kootenai Subbasin and the Idaho portions of the Moyie Subbasin lie entirely in Boundary County, which has a population of 9,189. From 1990 to 1997, the population of Boundary County increased 18.6%, and the county added 223 people a year with three-fourths of those from net migration, or the difference between people moving in and out of the county (Bonners Ferry Chamber of Commerce 2003). The most populous city in Boundary County is the County Seat of Bonners Ferry, with a population of 2,193. Other cities in Boundary County include Porthill, Copeland, and Naples in the Lower Kootenai Subbasin, and East Port and Moyie Springs in the Moyie Subbasin.

Most of the Upper Kootenai Subbasin and a very small portion of the Lower Kootenai Subbasin lie in Bonner County, which has a population of 31,890. The Bonner County population has been growing steadily, averaging 7-8% growth per year in the past five years (Bonner County Idaho 2003). The County Seat is Sandpoint, which is the most populous city in the county (5,203). The only towns in Bonner County that lie within the Lower Kootenai Subbasin are the towns of Elmira and Bonners Ferry. No major towns in the Upper Kootenai Subbasin exist in Idaho. The population of both Bonner and Boundary Counties continue to grow as a result of the recreational opportunities, beautiful scenery, and quality of life the counties have to offer (Bonner County Idaho 2003 and Bonners Ferry Chamber of Commerce 2003). Counties are shown on the map in Figure 18.

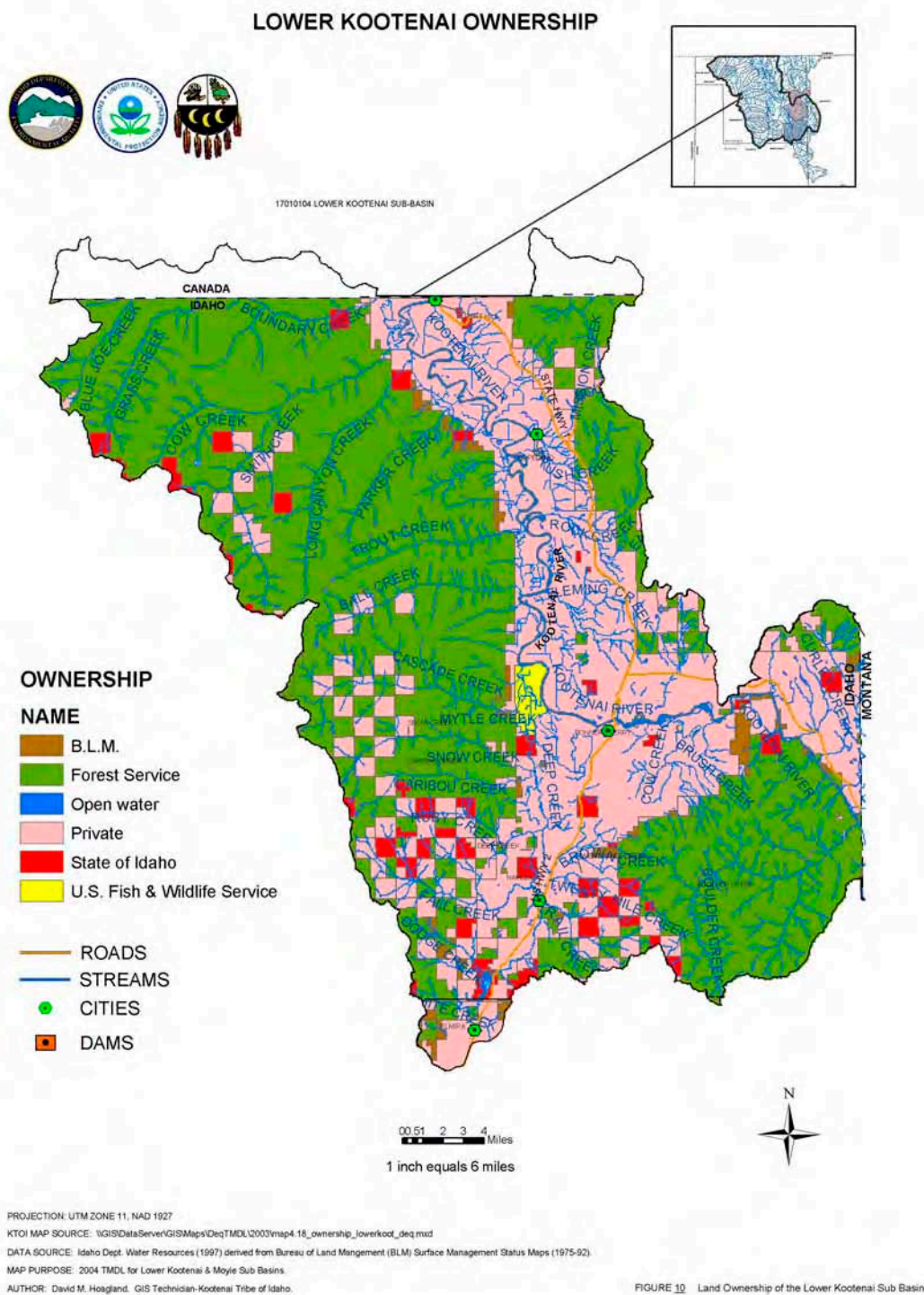


Figure 16. Land ownership in the Lower Kootenai River Subbasin.

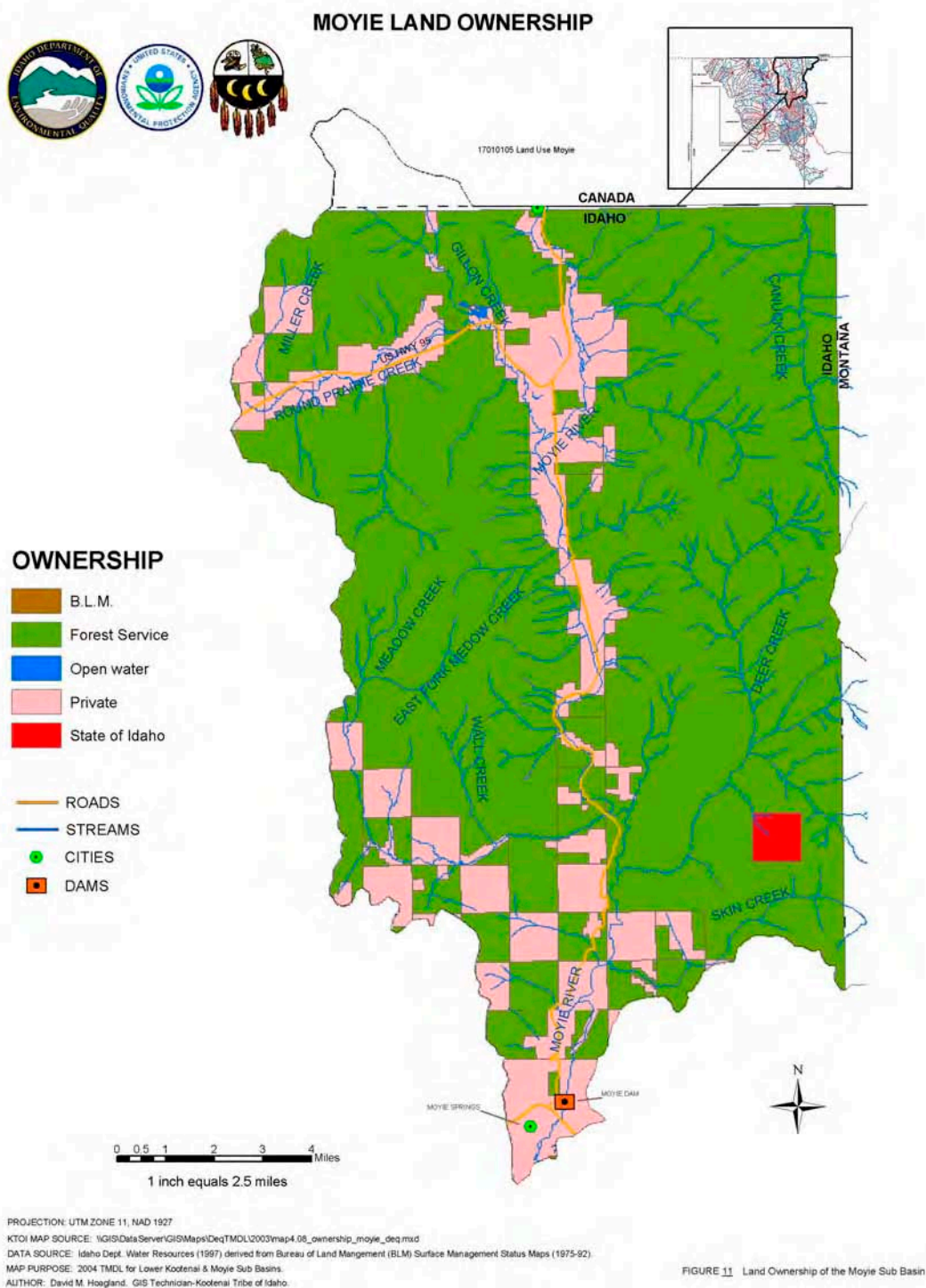


Figure 17. Land ownership in the Moyie River Subbasin.

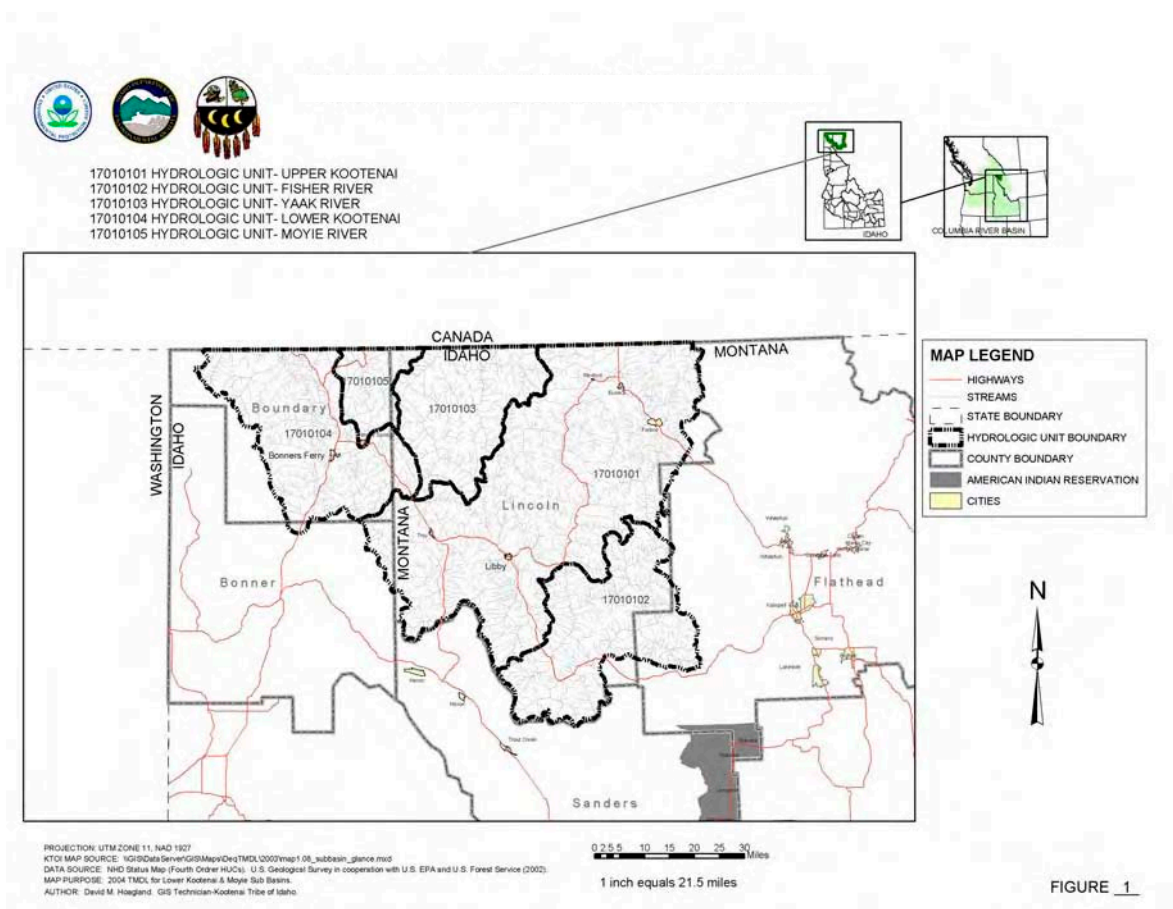


Figure 18. Kootenai River Subbasin hydrologic units.

1.3.3. History and Economics

The original inhabitants of Boundary County were the members of what is now known as the Kootenai Tribe of Idaho (Bonners Ferry Chamber of Commerce 2003). The Tribe is one of seven bands of the Kootenai Nation, which exists throughout Northern Idaho, British Columbia, and Northwestern Montana. In addition to the Kootenai Tribe of Idaho, the Nation is made up of the Lower Kootenai Band near Creston, BC; the St. Mary's Band near Cranbrook, BC; the Columbia Lake Band near Windermere, BC; the Shuswap Band near Invermere, BC; the Tobacco Plains Band near Fernie, BC; and the Confederated Salish and Kootenai Tribe (Shottanana 2003). The Kootenai Tribe has occupied the area since ancient times, and has used the natural resources of the land for hunting, fishing, and gathering items such as berries, moss, and other plants used for medicinal or ceremonial gatherings (Shottanana 2003). In 1991, the Tribe built the Kootenai Tribal Sturgeon Hatchery to help increase the population of the endangered sturgeon species, which plays a large role in their tribal heritage (Bonners Ferry Chamber of Commerce 2003). Currently, about 75 members of the Kootenai Tribe of Idaho live in a modern village at an 18-acre mission three miles northwest of Bonners Ferry. The Tribe made a significant contribution to the economy of the area in 1986 by building the Kootenai River Inn at Bonners Ferry. In 1993, the luxury hotel

also became a center for bingo and gaming machines, increasing the number of jobs, as well as the number of visitors to the area (Bonners Ferry Chamber of Commerce 2003).

Since the late 1800s, timber production has been the foundation of economic stability in the Lower Kootenai and Moyie Subbasins. In 1913, the Bonners Ferry Lumber Company grew to be one of the world's largest lumber mills producing 50 million board feet (Tom Hudson Company 2001). Employment in mills and logging reached an all time high of 704 in 1997 (Bonners Ferry Chamber of Commerce 2003). The timber industry employs not only the loggers and mill workers, but also members of railroad crews working with the industry. Since the 1920s and 30s, agriculture has been a significant industry in the subbasins, as well, with a variety of crops, fruits, and vegetables being grown in the fertile Kootenai River Valley.

Although it is no longer prominent, mining was a major industry in the 1800s. When gold was discovered in British Columbia in 1863, a rush of settlers from the west came north over the Wildhorse Trail. A ferry was established by Edwin Bonner in 1864 where the trail crossed the Kootenai River, and by 1883, a steamboat called "Midge" was carrying passengers and freight between the town soon to be known as Bonners Ferry and British Columbia. Railroads were soon developed as well, with the Great Northern Railroad (now Burlington Northern Sante Fe Railway) being built in 1892, and the Spokane International (now Union Pacific) and Kootenai Valley lines (now ceased) soon following (Bonners Ferry Chamber of Commerce 2003). The Spokane International and Burlington Northern Railroad systems remain active in the area today.

One of the most prominent mines of the time was the Idaho Continental Mine, which was discovered in 1890 on the crest of the Selkirk Range in northwestern Boundary County near Porthill, Idaho. The mine produced large quantities of lead and silver, as well as smaller amounts of gold, zinc, and copper. Ore was shipped out of the mine until 1980, the same year it was leased by New Idaho Continental Mines. In 1984, a cooperative program between the United States Forest Service, the Idaho Department of Health and Welfare, the Soil Conservation Service (now the Natural Resources Conservation Service), the University of Idaho, the Idaho National Guard, and New Idaho Continental Mines, Inc., was formed to reclaim the Idaho Continental Mine tailings piles (Mitchell 2000). Through this program, it was found that the major sources for metals in Blue Joe Creek, which is currently on the §303(d) list for failing to meet water quality criteria, are seepage and leaching of tailings piles of the Idaho Continental Mine's tunnel No. 5 (Mitchell 2000). Currently, no active mines are present in the Lower Kootenai and Moyie Subbasins; however, remnants of past mines are still affecting water quality today. Environmental cleanup activities have been completed and Blue Joe Creek is recovering. More details are in the Key Findings portion of the Executive Summary, and in section 2.4.5.

Wages in Boundary County, as in many rural counties in Idaho, tend to be lower than in most of the United States. That partly reflects the county's lower cost of living, but also results from long-term high unemployment, which tends to push wages down. Low wages and relatively high unemployment keep income levels below the national and state income levels. In the 1990s the county enjoyed strong job growth, however, the timber industry's decline and the U.S. economic slowdown eroded the county's employment base. In 2004, the economy showed renewed strength.

The Kootenai Valley was full of resources and opportunity, making it known as the "Nile of the North" (Tom Hudson Company 2001). The substantial migration of ore-seeking settlers to the area caused a great deal of hardship on the Kootenai Tribe, as the natural resources the Tribe valued were the same as the resources drawing the settlers to the country. However, the Kootenai River played an essential role for both groups by providing sources of food, transportation, and recreation, and by promoting economic stability in the subbasins as it does today.

Today, local governments and civic groups work together on water quality issues in the Upper and Lower Kootenai and Moyie River Subbasins.